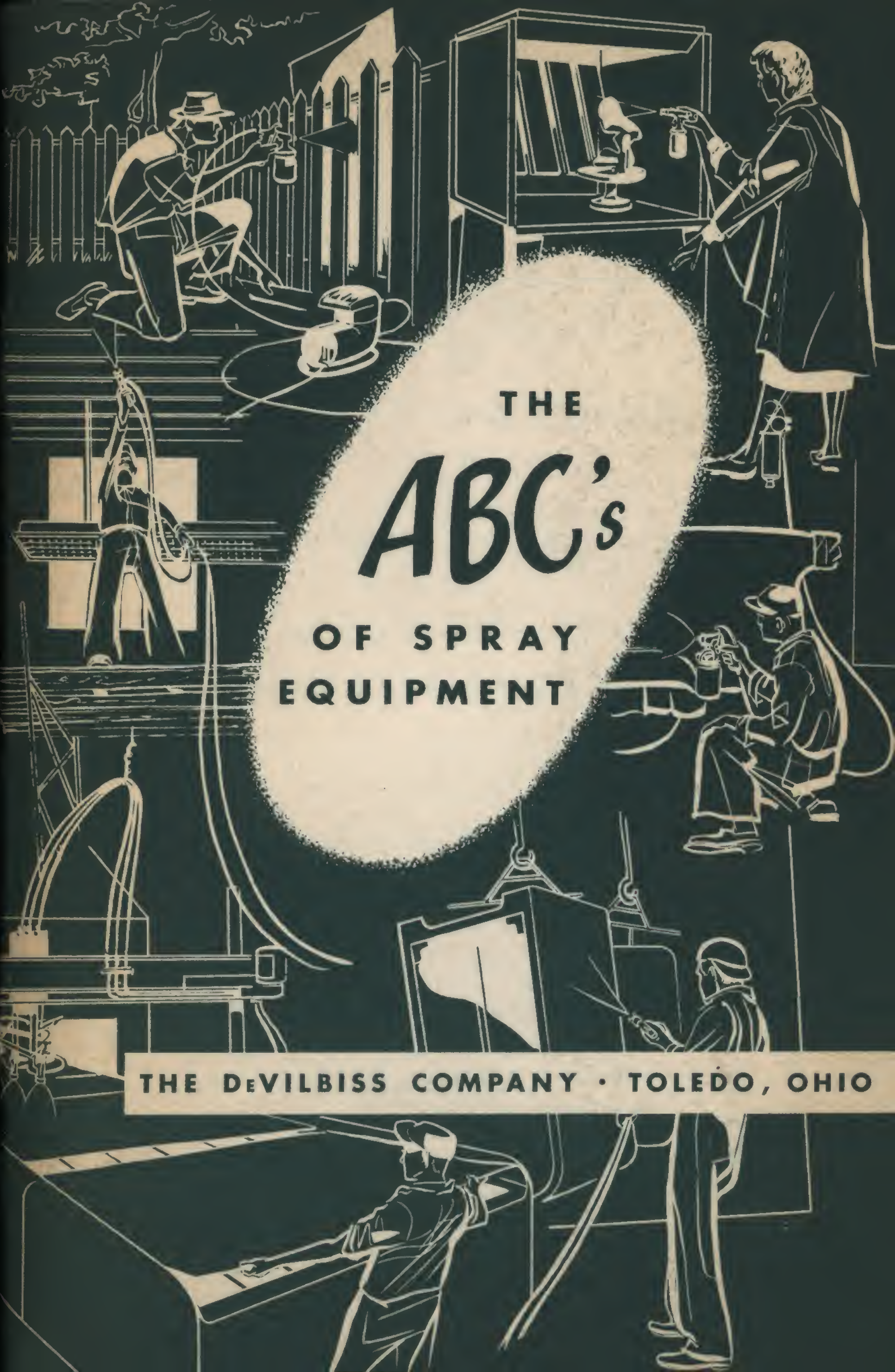

THE ABC's OF SPRAY EQUIPMENT

THE DeVILBISS COMPANY · TOLEDO, OHIO

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THE ABC's
OF SPRAY EQUIPMENT

Answers to the most common questions pertaining to Spray Guns, Cups, Tanks, Air Filters and Regulators, Air Compressors, Respirators, Spray Booths and other Spray Equipment, plus suggestions for selection, operation and maintenance.

THIRD EDITION

THE DEVILBISS COMPANY
TOLEDO, OHIO

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FOREWORD

This booklet is written to help you attain to the fullest measure the advantages of the spray method. By learning more about the equipment required for the job and how to maintain and operate it properly, you can achieve finer finishes with less effort, less wear and tear on equipment, and with savings in material.

Whether you are a production line spray operator, an automobile or furniture refinisher, a maintenance painter, or an amateur home craftsman, the material in this booklet will help you do a better job of spraying.

Based on questions repeated most often at The DeVilbiss School of Spray Painting, the fundamentals of use, care and operation are discussed in question-and-answer form and should give the reader an adequate working knowledge of spray finishing.

The various types and combinations of equipment best suited to different spray operations can be most simply described by dividing them into three general categories: Maintenance Painting, Suction Feed Spraying, and Industrial Finishing.

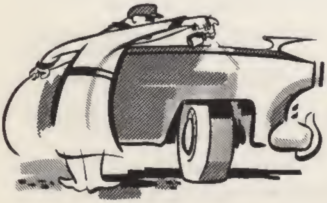
THE MAINTENANCE PAINTING FIELD

covers in general the application of paints and pro-

tective coatings to new as well as old construction and usually requires light or heavy duty, portable equipment such as:

- a. Portable air compressor
- b. Hose to convey air from compressor to material tank or pump
- c. Pressure feed tank or material pump
- d. Hose to convey air to the spray gun
- e. Hose to convey material to the gun
- f. Pressure feed spray gun
- g. Air controlling device such as an air adjusting valve attached to the spray gun or an extra air regulator and gauge installed at the tank.

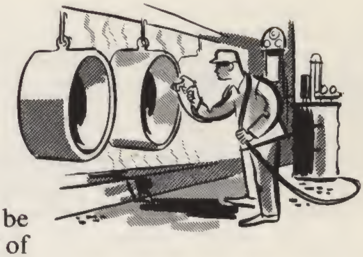
Since this equipment is moved from one job to another, an exhaust booth is not practical but in some cases an exhaust system may be improvised or a respirator used.



SUCTION FEED SPRAYING

as employed by the automobile, furniture or appliance refinisher is another major classification. This type of operation is generally carried on at one fixed location and calls for more stationary equipment, closer control of atomization air and cleaner working conditions due to the finer more critical finishes involved. Basic requirements include:

- a. Stationary air compressor
- b. Piping from compressor to air filter and regulator (transformer)
- c. Air filter and regulator (transformer)
- d. Air hose linking transformer to the spray gun
- e. Suction feed paint cup and cup attachment
- f. Suction feed spray gun
- g. Exhaust fan or spray booth



INDUSTRIAL FINISHING

the third category, may be defined as the application of finishing materials to a product during its original manufacture. Applying finishes to appliances, automobiles and other manufactured goods on the factory production lines at high rates of speed are examples of this type finishing operation.

Industrial finishing is practically always done in a spray booth, either dry or water wash type, and air from a stationary compressor is piped to an air filter and regulator (transformer) installed at the booth. Air hose is connected to the transformer and linked with a pressure feed paint tank located in or near the booth. From the tank, air and fluid hoses lead to a pressure feed spray gun. In some installations the atomization air hose is connected from the transformer directly to the gun.

In many cases the pressure feed tank is replaced by a material pump. Material is supplied to the guns through a pipeline by pump pressure from a remote mixing and paint supply room.

FOR THE HOME OR FARM WORKSHOP

and other smaller operations, spray painting equipment requirements can be reduced to a small portable compressor, a length of hose, and either a suction feed spray gun and cup or a pressure feed gun and tank.

SPRAY GUNS

1. What is the spray gun?

A spray gun is a tool using compressed air to atomize sprayable material and apply it to a surface. Air and material enter the gun through separate passages and are mixed and ejected at the air cap in a controlled pattern.

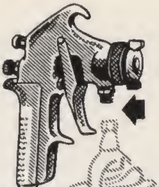


Fig. 1

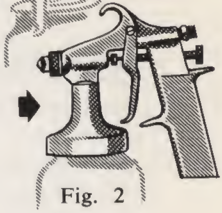


Fig. 2

2. What types of spray guns are there?

Spray guns are of the separate container (Fig. 1) or attached container (Fig. 2) types. These two types can be further divided into bleeder and non-bleeder, external and internal mix and pressure, gravity or suction feed guns. Other types include automatic, extension and special spray guns.

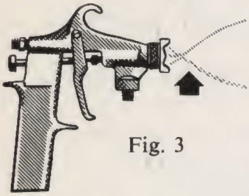


Fig. 3

3. What is a bleeder type gun?

A spray gun designed without an air valve. Air passes through the gun at all times preventing pressure build-up in the air lines and therefore is used with small air compressing outfits of limited capacity and pressure having no pressure controlling device such as an unloader or pressure switch. The trigger controls only the flow of fluid in this type of gun (Fig. 3).

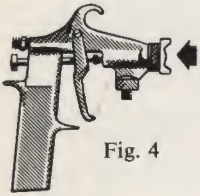


Fig. 4

4. What is a non-bleeder type gun?

A spray gun equipped with an air valve which shuts off the air when the trigger is released (Fig. 4). In this type of gun, the trigger controls both air and fluid flow. It is used wherever a pressure controlling arrangement is present in the compressed air supply system.

5. What is an external mix gun?

A spray gun that mixes and atomizes air and material outside the air cap (Fig. 5). A gun of this type can be used for applying almost all fluid material and is the only type suitable for fast drying materials such as lacquer.

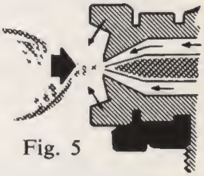


Fig. 5

6. What is an internal mix gun?

A spray gun that mixes air and material inside the cap before expelling them (Fig. 6). This gun is used where low air pressures are employed or where slow-drying materials not containing abrasive pigment or particles are to be sprayed. For example—Spraying flat wall paint or outside house paint with a ¼ or ⅓ H.P. compressor.

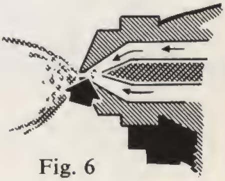


Fig. 6

7. What is a suction feed gun?

A type of spray gun in which a stream of compressed air creates a vacuum allowing atmospheric pressure to force material from an attached container to the spray head of the gun. This gun is usually limited to quart-size containers or smaller and is easily identified by the fluid tip extending slightly beyond the air cap (Fig. 7). Suction feed guns are used where there are many color changes and small amounts of material involved such as in auto or furniture refinishing.

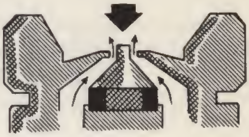


Fig. 7

8. What is a pressure feed gun?

A spray gun with an air cap not necessarily designed to create a vacuum. (The fluid tip is generally flush with the air cap.) Material is forced to the gun by air pressure from a tank, cup or pump. When large amounts of the same color material are being used, when the material is too heavy to be siphoned from a cup or container by suction, or when fast application is required, a pressure feed gun is used. Some examples are—production spraying in a manufacturing plant, and applying maintenance paints or heavier materials such as roof coatings (Fig. 8).

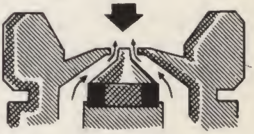


Fig. 8

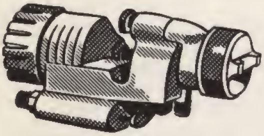


Fig. 9

9. What is an automatic spray gun?

A pneumatically operated spray gun for automatically coating objects that can be carried past it on a moving conveyance (Fig. 9). Automatic guns generally use the same air caps and tips as manually operated production guns and therefore the recommendations for operation and maintenance are practically identical with those for hand guns.

Automatic guns are used with the following described automatic spraying machines:

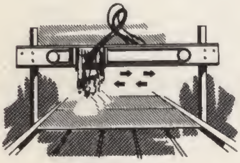


Fig. 10

Horizontal transverse machine—A spray machine which moves automatic guns horizontally back and forth across a conveyor carrying work to be coated (Fig. 10).

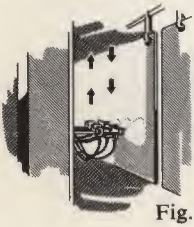


Fig. 11

Vertical transverse machine—A spray machine which moves automatic guns vertically before a surface to be coated (Fig. 11).

Rotary turntable type machine—A machine utilizing a revolving table with spindles mounted on the outer edge for holding work to be coated as it rotates in front of automatic spray guns (Fig. 12).

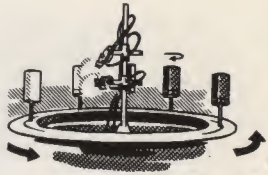


Fig. 12

Chain-on-edge machine—A machine named for the type of conveyor carrying the work to be sprayed. This type of conveyor consists of a moving chain equipped with work-holders which carry articles to be sprayed in front of the automatic spray guns (Fig. 13). On certain models the guns follow the work and coat interiors as well as exteriors of objects at a very rapid rate.

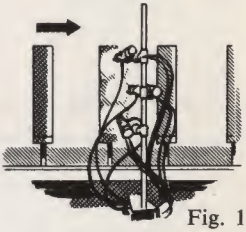


Fig. 13

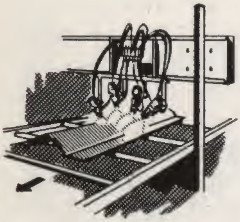


Fig 14

Gang spray—A series of automatic guns or sprayheads mounted in fixed positions to produce overlapping spray patterns through which the work to be coated passes on a conveyor (Fig 14).

10. What is a continuous sprayhead?

The sprayhead portion of a spray gun built expressly for all types of continuous spray applications where it is not necessary to start and stop the spray frequently (Fig. 15). It produces a finely atomized spray pattern with all kinds of sprayable material and is widely used on all types of automatic and gang spray applications. Holders for the sprayhead mount on rods and can be set as close as on 2″ centers.

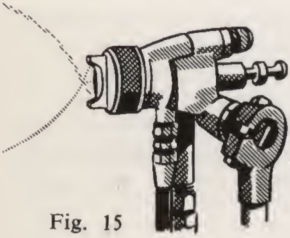


Fig. 15

11. What is a gravity feed spray gun?

A spray gun that is fed from an overhead container by force of gravity. Gravity feed guns are seldom used nowadays except for a few highly specialized applications.

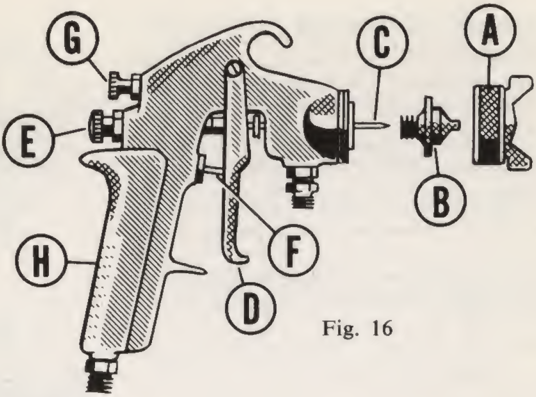


Fig. 16

12. What are the principal parts of a spray gun?

The principal components (Fig. 16) are the Air Cap (A), Fluid Tip (B), Fluid Needle (C), Trigger (D), Fluid Adjustment Screw (E), Air Valve (F), Spreader Adjustment Valve (G) and Gun Body (H). Guns equipped with a removable sprayhead will also have a locking bolt. (See Fig. 22.)

13. What is the air cap?

That part at the front of the gun which directs compressed air into the material stream to atomize it and form it into a spray. The cross section of this spray is called the spray pattern. There are various style caps producing different sizes and shapes of patterns for all types of applications (Fig. 17).

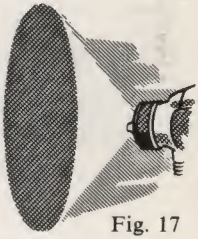


Fig. 17

14. What types of air caps are there?

All air caps can be divided into External or Internal mix types.

External mix caps are used with either suction or pressure feed and eject air through one or more holes to atomize the fluid (Fig. 5). External mix caps range from single orifice types to multiple jet caps with as many as 15 orifices for production spraying.

Internal mix caps mix air and material inside the gun before ejecting them through a single slot or round orifice and are used only with pressure feed. Atomization air and material pressure must be approximately equal at the gun (Fig. 6).

15. What are the advantages of the multiple jet cap? (Fig. 18)

(a) Better atomization for the more viscous materials such as synthetics, heavy bodied lacquers, etc.
(b) Higher atomization pressures can be used on more viscous materials with less danger of split spray pattern.
(c) Greater uniformity in pattern due to better equalization of air volume and pressure from cap.
(d) For materials that can be sprayed with lower pressures, multiple jet caps provide better atomization with less air.

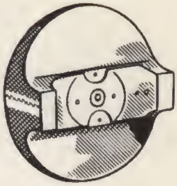


Fig. 18

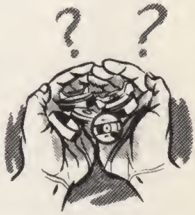


Fig. 19

16. How should an air cap be selected? (Fig. 19)

On the following factors:

(a) Volume of air (in cubic feet per minute) and pressure (in pounds per square inch) available.
(b) Material Feed system to be used—pressure, suction, or gravity feed.
(c) Type and volume of material to be sprayed.
(d) Nozzle size of fluid tip to be used. Most air caps work best with certain nozzle sizes.
(e) Size and nature of object or surface to be sprayed. Many or large orifices increase ability to atomize more material for painting large objects with great speed. Fewer or smaller orifices usually require less air, produce smaller spray patterns and deliver less material to conveniently paint smaller objects or apply coatings at lower speeds.

17. What is the fluid tip?

A nozzle directly behind the air cap which meters and directs the material into the air streams. The fluid tip forms a seat for the fluid needle which shuts off the flow of material. Fluid tips are available in a variety of nozzle sizes to properly handle materials of various types and pass the required volume of material for different speeds of application.

18. What are the standard nozzle sizes?

The standard nozzle sizes and their corresponding fluid tip opening dimensions are as follows:

D —.086″ EE—.070″ FZ—.047″ G —.028″ AC—.110″
DE—.078″ EX—.070″ FX—.0425″ H —.018″ CS —.110″
E —.070″ FF—.055″ F —.041″ AS —.140″

19. How are nozzle sizes identified?

By letter or dimension stamped on the fluid tip and needle.

20. Which nozzle sizes are most common?

E, FF, FX, and F are most generally used.

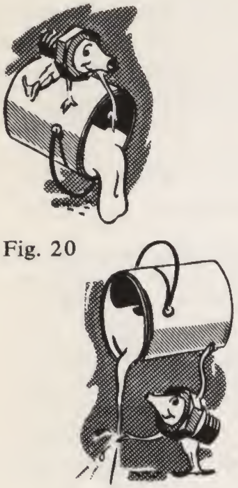


Fig. 20

21. How should the fluid tip be selected? (Fig. 20)

In selecting the proper fluid tip, consideration should be given to several important factors:

(a) Heavy, coarse or fibrous materials require large nozzle sizes to permit passage of the material and prevent clogging.
Example—Texture paints—3/16″ AS or CS nozzle (pressure feed only).

(b) For best atomization of material, select the smallest nozzle size which still has the capacity to pass an adequate amount of material for the job required.

(c) Very thin materials that sag readily are applied with small nozzle sizes which permit more effective control of fluid pressures.
Example—Stains—FF Nozzles—Suction Feed
F Nozzles—Pressure Feed

(d) Abrasive or corrosive materials must be handled with tips made of wear-resistant or non-corrosive metals.
Example—Latex, metal cleaners and wood bleaches require non-corrosive tips. Porcelain enamel requires abrasion-resistant tips.

(e) Type of material feed to be used. To attain a given rate of fluid flow, pressure feed set ups operate with smaller tips than suction feed.
Example—EX or E Nozzle—Suction feed
F, FX or FZ Nozzle—Pressure feed

22. What are some typical uses of various nozzle sizes?

1/2", 3/8" and 1/4"	Sound deadeners, underbody coatings, and heavy roof coatings.
3/16" AS and CS	Heavy, decorative type texture paints and lighter roof coatings.
AC	Asphalts, adhesives, and other slightly heavier than average materials.
D	Porcelain enamels and suction feed spraying of lacquer and air dry synthetics on large surfaces.
E	Pressure feed spraying with production guns—general purpose size for smaller, suction feed guns.
EE	Porcelain enamels with pressure feed.
EX	General purpose suction feed spraying with suction feed guns.

FF	Furniture varnish, oil base enamels, aluminum paint, (this is an intermediate size between the E and FX nozzles).
FZ	Special nozzle for production automobile spraying.
FX	Pressure feed production spraying—synthetics and lacquers.
F	Small pressure or suction feed guns.
G & H	Dyes and water-thin materials.

NOTE—*Tips and needles must always be of the same size. For example, an E tip requires an E needle. Some needles fit more than one tip size but are so designated. A size "D-EX" needle, for example, can be used with a "D" or "EX" tip.*

23. Of what metals are fluid tips made?

Tips are made of the following metals:

(a) Hardened steel for ordinary materials not corrosive or exceedingly abrasive.

(b) Nitralloy for abrasive, but not corrosive materials.

(c) Stainless steel for corrosive materials.

(d) Carboloy inserts for extremely abrasive materials.

24. What is the spreader adjustment valve?

A valve for controlling the air to the horn holes which regulate the size of a spray pattern from maximum width down to a narrow or round pattern. (See Fig. 16.)

25. What is the fluid needle adjustment?

This adjustment controls the travel of the fluid needle which allows more or less material through the fluid tip. (See Fig. 16.)

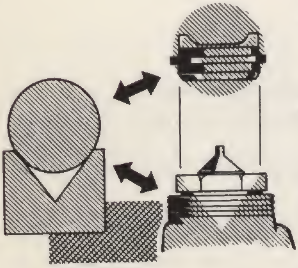


Fig. 21

26. What is the "ball and cone" principle?

A feature (Fig. 21) which assures perfect alignment between the air cap and fluid tip. A precision machined conical surface on the tip provides a seat for the precision machined ball segment of the cap.

27. What is a removable sprayhead and what are its advantages?
A feature which allows the sprayhead (an assembly consisting of the air cap, fluid tip, fluid needle and sprayhead body) to be quickly removed as a unit from the spray gun body. Its advantages are:

(a) Quick change from one material or color to another. One spray gun with several heads will answer the purpose of what otherwise may require several guns.

(b) Ease of cleaning.

(c) In case of damage to front of gun, new gun body is not required.

(d) An extra sprayhead can be substituted for one being repaired or cleaned.

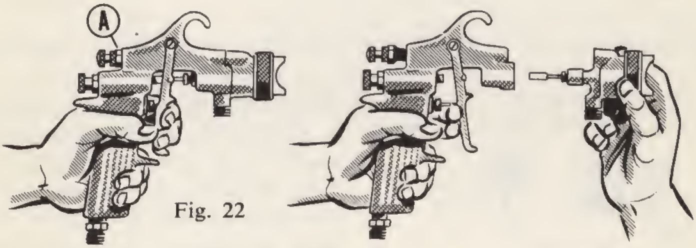


Fig. 22

28. How is the removable sprayhead removed?
Hold gun in left hand (Fig. 22) and pull trigger all the way back. Loosen the locking bolt (A), which holds the sprayhead and the gun body together, and unscrew it from the head. Push the trigger forward as far as possible with back of fingers. Pull the sprayhead forward. To replace, push trigger forward and insert sprayhead. Pull trigger back and tighten the locking bolt.

Cleaning And Lubricating The Gun

29. How should the air cap be cleaned?
By simply immersing it in clean solvent and drying it by blowing it off with compressed air. If small holes become clogged soak the cap in solvent. If reaming is still necessary, use a match stick, broom straw, or any other soft implement (Fig. 23). Digging out holes with wire or a nail may permanently damage the cap.

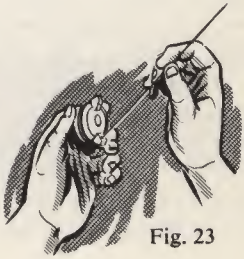


Fig. 23

30. How should guns be cleaned?

A suction feed gun and cup should be cleaned as follows: Loosen cup from the gun and while the fluid tube is still in the cup, unscrew the air cap about two to three turns, hold a cloth over the air cap and pull the trigger. Air diverted into the fluid passageways forces material back into the container (Fig. 24). Empty cup of material and replace with a small quantity of solvent. Spray solvent through the gun to flush out the fluid passageways (Fig. 25). Then remove the air cap, clean as directed above and replace it on the gun. Wipe off the gun with a solvent-soaked rag, or if necessary brush the air cap and gun with a fiber brush using clean-up liquid or thinner.

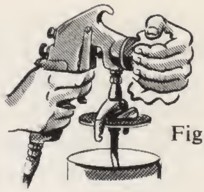


Fig. 24

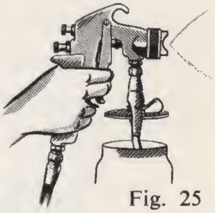


Fig. 25

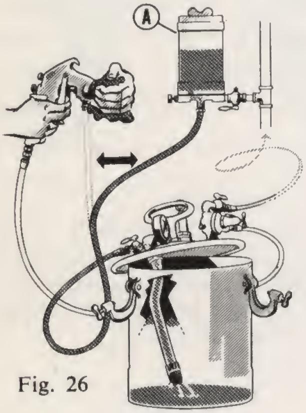


Fig. 26

A pressure feed system is cleaned as follows: To clean a pressure feed system, back up the air pressure regulating adjusting screw on the tank, release pressure from the tank by means of the relief valve or safety valve, loosen the spray gun air cap ring 3 turns, hold a cloth over the air cap and pull the trigger to force material back into the tank (Fig. 26). Then remove fluid hose from the gun and attach it to a hose cleaner (A). Run air and solvent through the hose and the fluid tube on the tank. Dry hose with compressed air. Clean air cap and fluid tip. Clean out tank and reassemble for future use.

31. What is a hose cleaner?

A device which forces solvent and air through fluid hose and guns, ridding them of paint residue. A valve stops the flow of solvent and allows air to dry the equipment being cleaned. (See Fig. 26.)

***NOTE**—It is a common malpractice to clean spray guns by placing the entire gun in solvent. Immersing the gun in solvents allows sludge and dirt to collect in the air passages of the gun. This dirt and sludge is then blown on the surface being sprayed the next time the gun is used. Solvents also remove lubricants and dry out packings.*

Do not use caustic alkaline solutions for cleaning spray guns because they etch away aluminum alloys as used in gun bodies and parts.

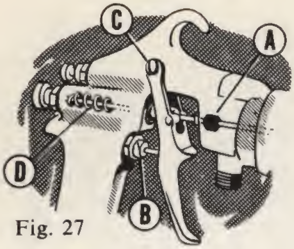


Fig. 27

32. What parts of the gun require lubrication? (See Fig. 27)

The fluid needle packing (A), air valve packing (B) and the trigger bearing screw (C). The fluid needle packing should be removed occasionally and softened with oil. The fluid needle spring (D) should be coated with petrolatum.

Spray Gun Troubles And Remedies

33. What causes fluid leakage from the fluid needle packing nut? A loose packing nut, worn packing, or dry fluid needle packing. Lubricate packing with a few drops of light oil. Tighten packing nut to prevent leakage but not so tight as to grip the fluid needle. It becomes necessary to replace the packing when it is worn.

34. What causes air leakage from the front of the gun? (See Fig. 28)

(a) Foreign matter on valve or seat.
(b) Worn or damaged valve or seat.
(c) Broken air valve spring.
(d) Sticking valve stem due to lack of lubrication.
(e) Bent valve stem.
(f) Packing nut too tight.
(g) Gasket damaged or omitted.

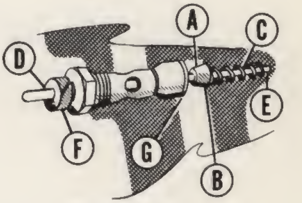


Fig. 28

35. What causes fluid leakage from front of the gun?

Fluid Needle (See Fig. 29) not seating properly due to:

(a) Worn or damaged fluid tip or needle.
(b) Lumps or dirt lodged in fluid tip.
(c) Packing nut too tight.
(d) Broken fluid needle spring.
(e) Wrong size needle.

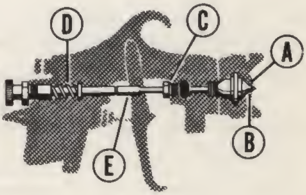


Fig. 29

36. What causes a jerky or fluttering spray?

Air leakage into fluid line (See Fig. 30) due to:
(Applying to both suction and pressure feed)
(a) Lack of sufficient material in container.
(b) Tipping container at excessive angle.
(c) Obstructed fluid passageway.
(d) Loose or cracked fluid tube in cup or tank.
(e) Loose fluid tip or damaged tip seat.
(Applying to suction feed only:)
(f) Too heavy a material for suction feed.
(g) Clogged air vent in cup lid.
(h) Loose, dirty or damaged coupling nut or cup lid.
(i) Dry packing or loose fluid needle packing nut.
(j) Fluid tube resting on bottom of cup.

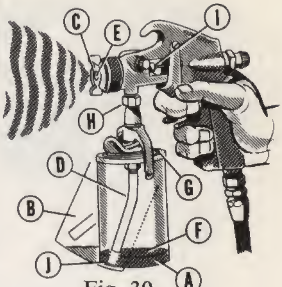


Fig. 30

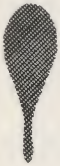


Fig. 31

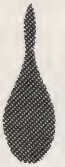


Fig. 32

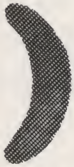


Fig. 33

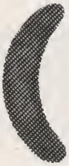


Fig. 34

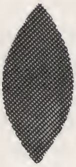


Fig. 35

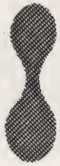


Fig. 36

37. What causes defective spray patterns?

(a) Top heavy pattern (Fig. 31) caused by:
  (1) Horn holes partially plugged.
  (2) Obstruction on top of fluid tip.
  (3) Dirt on air cap seat or fluid tip seat.
(b) Heavy bottom pattern (Fig. 32) caused by:
  (1) Horn holes partially plugged.
  (2) Obstruction on bottom side of fluid tip.
  (3) Dirt on air cap seat or fluid tip seat.
(c) Heavy right side pattern (Fig. 33) caused by:
  (1) Right side horn holes partially clogged.
  (2) Dirt on right side of fluid tip.
  (3) On twin jet air cap, right jet clogged.
(d) Heavy left side pattern (Fig. 34) due to:
  (1) Left side horn holes partially clogged.
  (2) Dirt on left side of fluid tip.
  (3) On twin jet cap, left jet clogged.

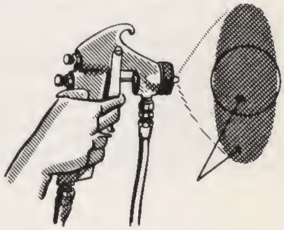


Fig. 37–
Normal Spray Patterns.

(e) Heavy center pattern (Fig. 35) caused by:
  (1) Too low a setting of the spreader adjustment valve.
  (2) With twin jet cap, too low an atomizing pressure or material being too thick.
  (3) With pressure feed, too high a fluid pressure for the atomization air being used or the material flow is in excess of the cap's normal capacity.
  (4) Too large a nozzle for the material used.
  (5) Too small a nozzle.
(f) Split spray pattern (Fig. 36) due to air and fluid not being properly balanced. Reduce width of spray pattern by means of the spreader adjustment valve or increase fluid pressure. This latter adjustment increases speed and the gun must be handled much faster.

Remedies

For (a) through (d):

Determine if obstruction is on air cap or fluid tip. This is done by making a test spray pattern then rotating the cap one half turn and spraying another pattern. If the defect is inverted (Fig. 38), obstruction is on the air cap. If not inverted, it is on the fluid tip. Clean the air cap as described on page 13. Check for fine burr on the edge of the fluid tip (remove with 600 wet or dry sand paper) or for dried paint just inside the opening (remove by washing).

For (e) through (f):

If adjustments are out of balance, readjust atomizing pressure, fluid pressure and spray width adjustment until the desired spray is obtained.

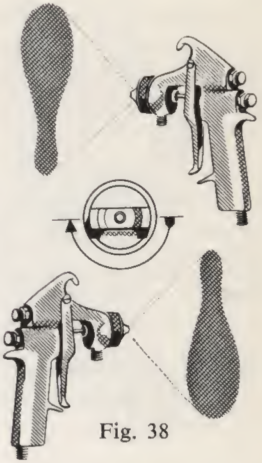


Fig. 38

Spray Gun Accessories

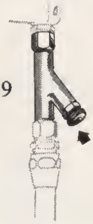


Fig. 39

38. What is an air adjusting valve?

A valve (Fig. 39) attached to the air inlet of the gun providing a means of regulating the atomizing air pressure.

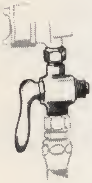


Fig. 40

39. What is a fluid cut-off valve?

A valve (Fig. 40) attached to the fluid inlet of the gun providing a means of shutting off fluid at the gun. This permits the gun to be detached from hose for cleaning, etc.

Some types have a "clean out" feature. If the gun becomes clogged, this feature permits material to be blown back through an exhaust port in the valve.

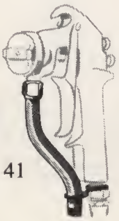


Fig. 41

40. What is a fluid inlet extension?

A tube (Fig. 41) which attaches to the fluid inlet on the gun allowing both air and fluid hose connections to be brought together at the handle of the gun.

SPRAY GUNS

41. What is a fluid strainer?

A device specially designed for attaching to the fluid inlet of the spray gun (A), or the fluid outlet of a pressure tank (B), to prevent any foreign matter from entering fluid passages and being deposited on the work (Fig. 42).

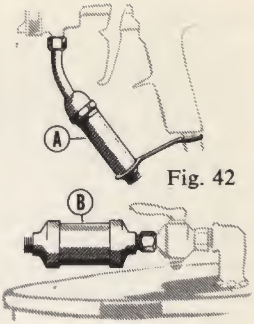


Fig. 42

42. What are air and fluid valves? (Fig. 43)

Air and fluid valves are attached to pressure tanks, compressing outfits, or other pieces of equipment to provide an outlet connection for hose, etc., and some means of turning on or off the air or fluid.

43. For accessories such as adapters, quick detachable connections, etc., see Hose section.

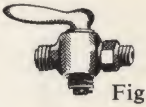


Fig. 43

MATERIAL CONTAINERS AND PUMPS

44. What are material containers?

Any container, glass or metal, which serves as material supply reservoir for the spray gun.

45. How many types of material containers are there?

There are three: Cup, tank, and gravity bucket types.

46. Where are cup containers used?

These small containers are used where comparatively small quantities of material are to be sprayed.

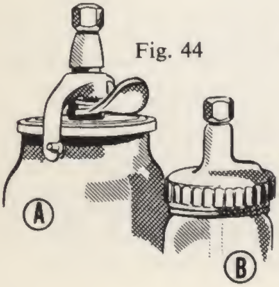


Fig. 44

47. What types of cup containers are there?

Suction and pressure feed types.

48. How are material feed cups attached to the gun?

By means of a lid assembly (often called a cup attachment) that either clamps (A) or screws (B) onto the cup container (Fig. 44). Some lid assemblies are detachable from the gun, others are a part of the gun. (See Fig. 2.)

49. What is a suction feed cup?

A small (usually no larger than one quart) vented container which allows atmospheric pressure to enter, forcing the material up to the fluid tip when a current of compressed air creates a vacuum at the orifice of the spray gun (Fig. 45). Commonly used where there is a small amount of thin material such as lacquer, synthetic enamel, stain, bronze, etc., being sprayed.

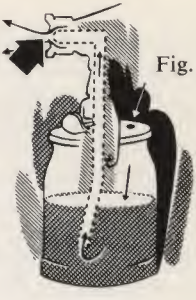


Fig. 45

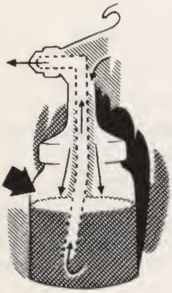


Fig. 46

50. What is a pressure feed cup?

Material container with a capacity usually no larger than two quarts, attached directly to the gun. Material is forced from the cup to the gun by compressed air (Fig. 46). A pressure feed cup is used for small quantities of enamels, and other materials too heavy for suction feed, such as flat wall paints, wood fillers, house paints, etc. If coarser atomization is required, such as spattering for special decorator effects, this type cup is used. They are used quite often in laboratories for testing materials.

51. How are pressure feed cups classified?

Regulator and non-regulator types.

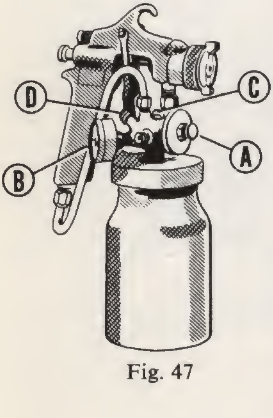


Fig. 47

The regulator type cup has a built-in regulator which controls the fluid pressure independently of the atomization air pressure (Fig. 47). A regulator cup is equipped with the following accessories: An air regulator to control pressure on the material (A), a gauge to indicate this pressure (B), a valve to release pressure from the cup and a safety valve to prevent excessive pressure (C), and in some cases an air adjusting valve to control atomization air to the gun (D).

The non-regulator cup has no pressure controlling device. Pressure on the material is the same as the atomization air pressure to the spray gun (See Fig. 46). It is generally used with small air compressing units.

52. What are the advantages of the regulator type cup?

With this cup, material can be sprayed with a greater degree of control. In operation it is a miniature pressure feed tank. It may be used for tests, experiments, etc., since it can be employed to duplicate production finishing operations.

53. When are non-regulator cups used?

When accurate control of fluid flow is not of major importance or generally with internal mix air caps, although external mix caps may be used. Occasionally, where a separate air line is run to the pressure cup from an independent pressure regulator, the non-regulator cup may be used for highly accurate fluid control.

54. What are pressure feed tanks and where are they recommended? (Fig. 48)

Pressure feed tanks are closed, metal containers, ranging in sizes from 2 to 120 gallons, that provide a constant flow of material at a uniform pressure to the spray gun. Fluid is forced out of the tank by compressed air applied to the material. To change the rate of flow, air pressure must be increased or reduced. Pressure tanks are constructed for working pressures as high as 110 pounds per square inch. Basically they consist of a shell (A), clamp-on lid (B), fluid tube (C), fluid header (D), air (E) and fluid (F) outlet valves, air inlet valve (G), and a safety relief valve (H). They are available with top or bottom outlets and various accessories.

Where continuous production is maintained, pressure feed tanks provide a practical, economical method of feeding material to the spray gun. The flow of material is positive and uniform. When tanks are equipped with agitators (I), material can be easily mixed and kept in suspension.

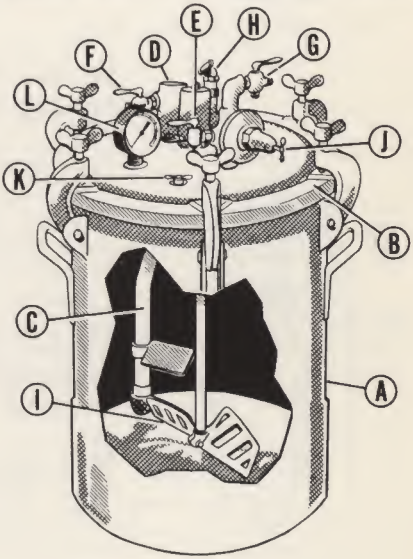


Fig. 48

MATERIAL CONTAINERS AND PUMPS

55. How many types of tanks are there? (See Fig. 48)
There are two types: Regulator and non-regulator:

Regulator types are equipped with a pressure regulator (J), or regulators, safety valve (H), release valve (K), and a pressure gauge (L), and are used for conveying large quantities of materials to the spray gun under constant and accurate control of fluid pressure.

Non-regulator types are equipped with only a safety valve and a release valve, and are used where pressure control is not of major importance. They are usually used with small compressors of limited capacity and pressure, and primarily with internal mix spray guns.

56. What are the advantages of the regulator type?

(a) Material flow can be regulated accurately to production requirements.

(b) Allows for adjustment to accommodate a wide range of material viscosities and permits pressure increases when added hose lengths demand them.

(c) Permits more adjustment of the balance between material flow and atomization pressure.

57. What is a single regulator tank?
A tank equipped with one regulator which regulates only the pressure on the material in the tank (Fig. 49). Single regulator tanks are also available with special regulators of greater sensitivity for use where more accurate control of fluid flow is necessary, such as electrostatic or automatic spraying. These extra-sensitive regulators will give very accurate control up to a maximum pressure of 30 pounds but are generally used to regulate fluid pressures under ten pounds.

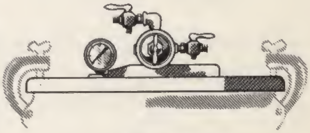


Fig. 49

58. What is a double regulator tank?
A tank equipped with two air regulators (Fig. 50), one providing regulation for the atomization air pressure to the spray gun and one controlling air pressure on the material in the tank.

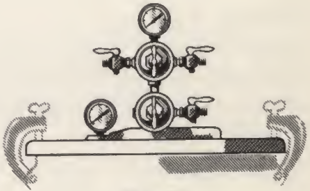


Fig. 50

59. Where are double regulator tanks used?

In operations where independent fluid and air pressure control is essential. Double regulation permits varying fluid and atomization pressures to meet any operating conditions. The fluid pressure may be higher or lower than the atomizing pressure, depending on the height at which the gun is operated above the tank, the degree of atomization desired, size and length of hose, speed of operation, etc.

60. Of what materials are tanks constructed?

Heavy-duty tanks for production and maintenance work are made of drawn steel. Shells are specially coated inside or lined with special material when designed for use with abrasive or corrosive materials. For example, tanks for porcelain enamel and other special materials may be equipped to combat special abrasion and corrosion with wear-resistant and non-corrosive shell or insert. Light duty tanks for smaller operations are welded steel construction.

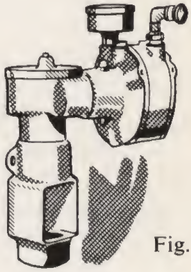


Fig. 51

61. When should tanks be equipped with agitators?

When materials require frequent or constant agitation, such as some pigmented lacquers or enamels.

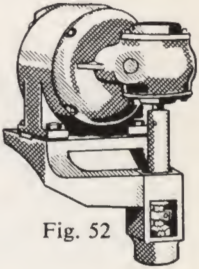


Fig. 52

62. How many types of agitator drives are there?

There are three: Air motor (Fig. 51), electric motor (Fig. 52), and hand operated (Fig. 53).

Air motor driven agitators are available on nearly all standard size pressure feed tanks. Since the motor is powered by compressed air, fire hazards are eliminated. Motor speeds are variable.

Electric motor driven models are available on all standard size pressure feed tanks. For use in hazardous conditions, they must be supplied with motors and wiring in accordance with the National Electrical Code.

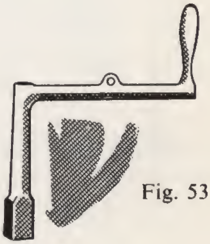


Fig. 53

Hand Operated agitators are used when material requires only occasional agitation.

63. What are insert containers?

Metal, pail-like vessels which are placed inside the tank to hold material instead of pouring it directly into the shell (Fig. 54). Inserts reduce tank cleaning to a minimum and make it more convenient to change from one color or material to another. They also permit several batches of material to be mixed in advance.

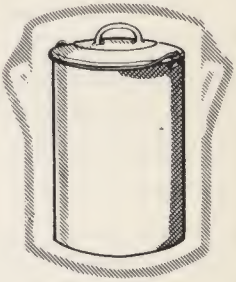


Fig. 54

64. What are gravity buckets?

Gravity feed buckets are material containers placed at a level above the spray gun, allowing the material to flow down to the gun. Gravity feed is seldom used today except in a few rare applications.

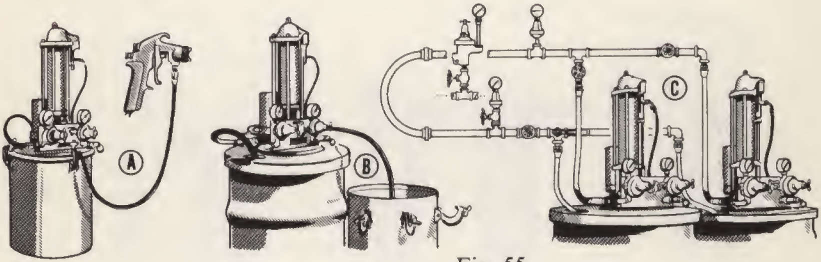


Fig. 55

65. What is a material pump?

An air or electrically driven device for forcing material from one point to another.

As spray equipment, material pumps are used for: (Fig. 55).

(a) Pumping material from a container to a spray gun at a desired operating pressure.

(b) Transferring material from a shipping container to mixing tanks, etc.

(c) Circulating systems for maintenance and industrial finishing.

MATERIAL CONTAINERS AND PUMPS

66. What are the more common types of material pumps?

Gear and piston types.

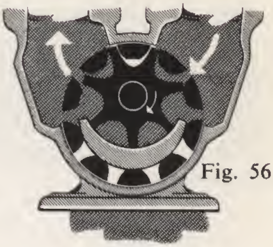


Fig. 56

The gear pump (Fig. 56) employs two or more gears to force material from one point to another. It is used for handling non-abrasive materials in circulating systems and for pumping material directly to the spray gun.

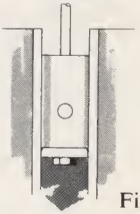


Fig. 57

A piston pump (Fig. 57) employs the action of a piston moving up and down within a cylinder to force material from one point to another. For handling sprayable materials in circulating systems and for pumping material directly to the gun, the piston pump is more widely used because it is less susceptible to the abrasive action of many materials. Materials too heavy for the conventional gear type pump call for the piston type pump for efficient handling.

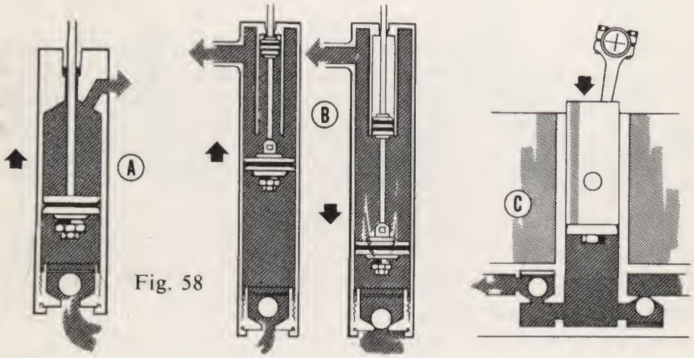


Fig. 58

67. What are the principal types of piston pumps? (See Fig. 58)

Single action, double action and multi-cylinder crank types.

The single action pump (A) creates a flow only on the alternate strokes of the piston.

The double action pump (B) delivers material on each stroke of the piston.

The multi-cylinder crank type pump (C) is a stationary unit used in larger circulating systems for handling all types of organic finishing materials at fluid consistency.

MATERIAL CONTAINERS AND PUMPS

68. What are some of the advantages of the air operated piston type material pumps?

(a) Pumps material directly from its original container.

(b) Capable of pumping material long distances and to high elevations.

(c) Provides material for more than one gun in the same operation.

(d) Provides material through either a circulating or "dead end" system.

(e) Handles abrasive materials with less wear on the pump than other types.

(f) Handles heavy bodied materials such as lubricants and sound deadeners.

(g) Powered by air there are no electrical devices to cause a hazard with combustible materials.

HOSE AND HOSE CONNECTIONS

69. What types of hose are used in spray painting? (Fig. 59)

Two types: Air and fluid hose.

Air hose usually has a red rubber cover although on small low pressure units it may be a black and orange braid covered hose.

Fluid hose is black or brown.

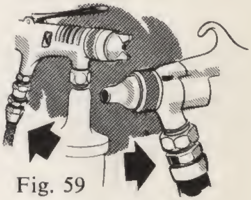


Fig. 59

70. How is hose constructed?

Braid covered hose (Fig. 60) is simply rubber tubing (A) reinforced by a woven cotton covering (B).

One braid, rubber-covered hose (Fig. 61) consists of an inner tube (A), a braid insert (B), and an outside cover (C) all vulcanized into one.

Two braid hose (Fig. 62) consists of an inner tube (A), a braid insert (B), a separator or friction layer (C), another layer of braid (D), and finally a rubber cover (E) all vulcanized into one.

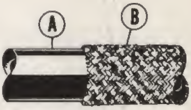


Fig. 60

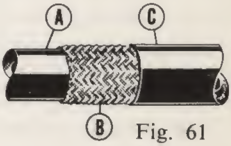


Fig. 61

71. What types of inner tube are used in fluid hose?

Special solvent-resisting liners which are practically impervious to the action of all common solvents in paints, lacquers, and other finishing materials that readily attack ordinary rubber composition hose.

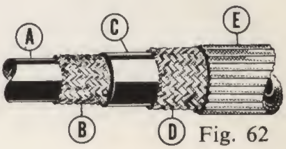


Fig. 62

HOSE AND HOSE CONNECTIONS

72. What sizes of fluid hose are used?

(a) Production finishing—Large guns—3/8″ I.D. and 5/16″ I.D. (inside diameter).

(b) Maintenance finishing—Large guns—1/2″ I.D. and 3/8″ I.D.

(c) Maintenance finishing—Small guns such as used with 1/4, 1/3 and 1/2 H.P. compressing outfits—5/16″ I.D.

(d) Underbody coatings—3/4″ I.D.

73. What sizes of air hose are used? (Fig. 63)

(a) From compressing outfit or transformer to gun (A) 5/16″ I.D. is recommended. 1/4″ I.D. may be used with small guns provided hose length does not exceed 12 feet.

(b) From compressing outfit to pressure feed tank (B) 7/16″ I.D. on large units—5/16″ I.D. on small ones.

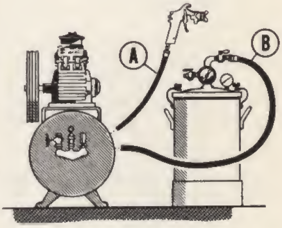


Fig. 63

74. What happens if too small an air hose is used?

The spray gun is "starved" for air due to an excessive pressure drop in the atomizing air line.

75. What is pressure drop?

Pressure drop is the loss of air pressure due to friction between the source of air and point of usage. This drop is caused by friction between the flowing air and the walls of the hose, pipe line, and passages it travels through.

That this friction is an important factor to consider is shown in the table on the accompanying page. These figures are based on the air consumption of a spray gun equipped with an air cap drawing approximately 12 cubic feet of air per minute at 60 pounds pressure. As illustrated at the right (Fig. 64), the difference between the regulated air pressure at the source (A), (in this case an air transformer), and the gun (B), is determined both by the size and length of the air hose (C).

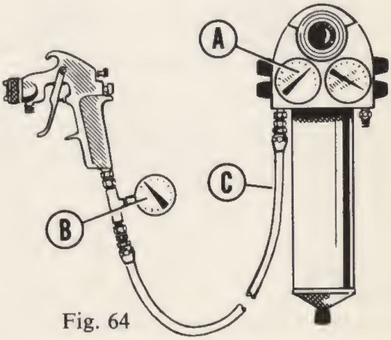


Fig. 64

HOSE AND HOSE CONNECTIONS

Table of Air Pressure Drop

Size of Air Hose Inside Diameter	Air Pressure Drop at Spray Gun					
	5-foot length	10-foot length	15-foot length	20-foot length	25-foot length	50-foot length
1/4-inch	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
At 40 lbs. pressure	6	8	9½	11	12¾	24
At 50 lbs. pressure	7½	10	12	14	16	28
At 60 lbs. pressure	9	12½	14½	16¾	19	31
At 70 lbs. pressure	10¾	14½	17	19½	22½	34
At 80 lbs. pressure	12¼	16½	19½	22½	25½	37
At 90 lbs. pressure	14	18¾	22	25¼	29	39½
5/16-inch						
At 40 lbs. pressure	2¼	2¾	3¼	3½	4	8½
At 50 lbs. pressure	3	3½	4	4½	5	10
At 60 lbs. pressure	3¾	4½	5	5½	6	11½
At 70 lbs. pressure	4½	5¼	6	6¾	7¼	13
At 80 lbs. pressure	5½	6¼	7	8	8¾	14½
At 90 lbs. pressure	6½	7½	8½	9½	10½	16

Too often a spray gun is blamed for functioning improperly, or a material is considered of inferior quality, when the real cause of the trouble is an inadequate supply of compressed air at the gun. Frequently operators believe they are using pressures as high as 100 lbs. (a much higher pressure than ever required) but investigation reveals that, due to a small hose size or extra long length, pressure is inadequate for proper atomization. There are, of course, other causes for less volume and pressure such as clogged air lines, too small an air transformer, etc.

76. What types of hose connections should be used in spray painting? Of the many different types used, the most common are—the threaded and the quick-detachable types.

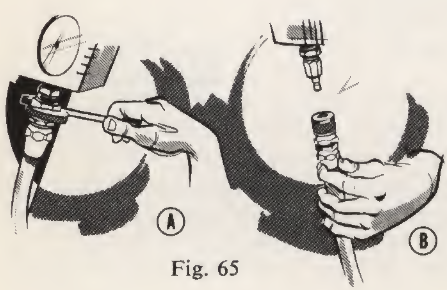


Fig. 65

The threaded connection is a screw type fitting usually tightened with a wrench (Fig. 65-A).

A quick-detachable connection is readily attached and detached by hand (Fig. 65-B).

Both the threaded and quick-detachable connections employ the compression ring principle in the manner in which they are attached to air or fluid hose.

HOSE AND HOSE CONNECTIONS

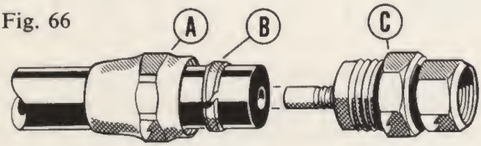
77. What is the compression ring principle?

A method of fastening connections to hose, employing a split brass ring slipped over the end of a length of hose. A stem is inserted and when a sleeve is slipped on and tightened, it clamps the hose to a perfect seal against the ridges of the stem. Some of the advantages of the compression ring coupling are as follows:

(a) They are economical because:
  (1) All parts may be re-used.
  (2) They save hose—no pinching or chewing of the hose cover.
  (3) They are tight—no leaks between connection and hose.

(b) They are convenient because:
  (1) They are easily removed and re-attached.
  (2) No special tools are required to attach them to the hose.
  (3) There are no projections to catch or snag.
  (4) They are available in either male or female types in all thread sizes common to air operated tools.

Fig. 66



78. How are these hose connections applied? (Fig. 66)

(a) Slip sleeve (A) and compression ring (B) over end of hose. (b) Hold body (C) in vise. (c) Push hose into body as far as it will go. (d) Slide ring up to body.
(e) Bring sleeve over ring and thread onto body—tighten with a wrench.

79. What is an adapter?

A connection (Fig. 67) male on one end and female on the other used to convert the connections on hose or equipment from one thread size to another. For example: 9/16″-20 thread to 1/4″ pipe thread; 3/8″ pipe thread to 9/16″-20 thread; 5/8″-18 thread to 3/8″ pipe thread.

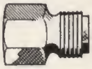


Fig. 67

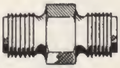


Fig. 68

80. What is a coupling?

A connection (Fig. 68) male on both ends used to couple two pieces of hose together or to convert a female connection of one size thread to a male connection of another size thread. For example: 9/16″-20 thread x 9/16″-20 thread; 9/16″-20 thread x 5/8″-18 thread; 5/8″-18 thread x 3/8″ pipe thread; 3/8″ pipe thread x 3/8″ pipe thread.

TRANSFORMERS, REGULATORS AND CONDENSERS

81. What is an air transformer?

An air transformer is a device which removes oil, dirt and moisture from compressed air; filters and regulates the air; indicates by gauges regulated air pressures; and provides outlets for spray guns, dusters, and other air tools.

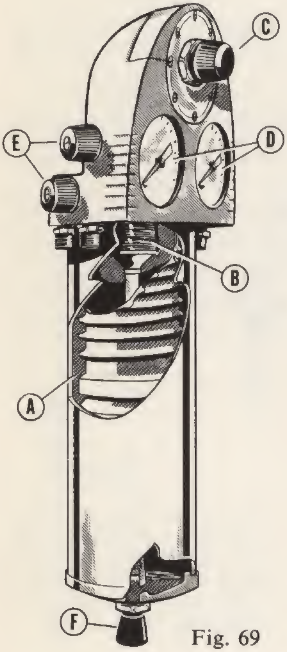


Fig. 69

82. What are the principal parts of an air transformer? (Fig. 69)

A condenser (A), filtering device (B), air regulator (C), pressure gauge or gauges (D), outlet valves (E) and a drain (F).

83. Where are air transformers used?

In all finishing or refinishing operations requiring a supply of clean, moisture-free, regulated air. Transformers have these added features:

(a) Several hose lines can be hooked-up to the regulated air supply—each with independent shut-off valves.

(b) Outlets are incorporated for filtered air at main line pressure for other air tools.

(c) Besides regulating air for spray guns, they may be used to accurately control the fluid pressure for paint tanks not equipped with regulators.

(d) Transformers are also valuable where air-operated tools other than the spray gun are used by supplying air at the pressures at which they work best.

84. How does the air transformer operate?

Entrained dirt, oil and moisture are removed by baffles, centrifugal force, expansion chambers, impingement plates, and filters. The transformer allows only clean, dry air to emerge from the outlets. The air regulating valve provides positive control, insuring uniform, regulated pressure. Gauges indicate regulated and, in some cases, main line air pressures, and valves provide outlets for hose lines to spray guns, tools, etc. The drain valve provides for elimination of accumulated sludge consisting of oil, dirt, and moisture.

85. How should the transformer be installed? (Fig. 70)

(a) Bolt transformer (A) securely to spray booth or some similar, sturdy object near the operator for convenience in reading the gauges and operating the valves. Install the transformer at least 25 feet from the compressing outfit (B).

(b) Take-off should be from the top of the air line (C).

(c) Piping should slope toward the compressor air receiver or a drain leg (D) installed at the end of the air line or at the end of each branch, to provide for drainage of moisture from the air line.

(d) Use piping of sufficient size for the volume of air passed and the length of pipe used. (See pipe recommendations below.)

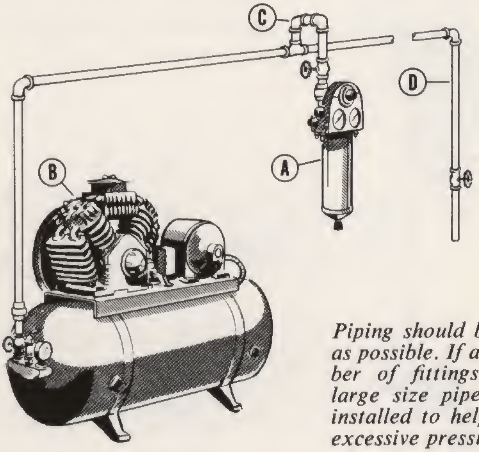


Fig. 70

Piping should be as direct as possible. If a large number of fittings are used, large size pipe should be installed to help overcome excessive pressure drop.

MINIMUM PIPE SIZE RECOMMENDATIONS

COMPRESSING OUTFIT		MAIN AIR LINE	
Size	Capacity	Length	Size
1½ & 2 H.P.	6 to 9 C.F.M.	Over 50 ft.	¾″
3 & 5 H.P.	12 to 20 C.F.M.	Up to 200 ft.	¾″
		Over 200 ft.	1″
5 to 10 H.P.	20 to 40 C.F.M.	Up to 100 ft.	¾″
		Over 100 to 200 ft.	1″
		Over 200 ft.	1¼″
10 to 15 H.P.	40 to 60 C.F.M.	Up to 100 ft.	1″
		Over 100 to 200 ft.	1¼″
		Over 200 ft.	1½″

TRANSFORMERS, REGULATORS AND CONDENSERS

86. How often should the transformer be drained?
Once a day or more frequently if necessary in humid weather.

87. What steps should be taken if moisture passes through the transformer?

(a) Drain transformer, air receiver and air line of accumulated moisture.

(b) Make certain that the transformer is located at least 25 feet from the compressing outfit.

(c) Main air line should not run adjacent to steam or hot water piping.

(d) Compressor air intake should not be located near steam outlets or other moisture-producing areas.

(e) Outlet on the air receiver should be near the top of the tank.

(f) Check for damaged cylinder head or leaking head gasket, if the compressor is water cooled.

(g) Intake air should be as cool as possible.

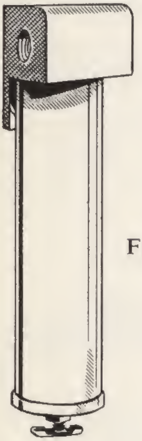


Fig. 71

88. What causes excessive pressure drop on the main line gauge of the transformer?

(a) Compressing outfit too small.

(b) Compressing outfit not functioning properly.

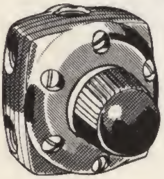
(c) Leakage in air lines.

(d) Partially opened valves.

(e) Air piping or hose line too small for volume of air required.

89. What is an air condenser? (Fig. 71)
An oil, moisture and dirt separator installed in an air line where no pressure reduction is required.

Fig. 72



90. What is an air regulator? (Fig. 72)
A device for reducing air pressure and automatically maintaining the required pressure with minimum fluctuations due to variations in the air supply pressure. Pressures for air tools, pressure tanks, etc., are held constant. Air regulators are used in air lines already equipped with traps or filters to remove dirt and moisture. They are available in different capacities, with or *without gauges*, and in *varying degrees of sensitivity*.

TRANSFORMERS, REGULATORS AND CONDENSERS

91. What is a fluid regulator? (Fig. 73)
A device used with circulating systems to control and maintain constant and correct fluid pressures to spray guns. Fluid regulators are available with or without pressure gauges and for standard or extra sensitive regulation.

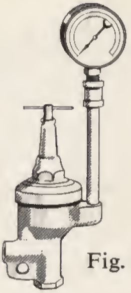


Fig. 73

AIR COMPRESSORS

92. What is an air compressor?
A machine designed to pump air from atmospheric to a higher pressure.

93. What types of compressors are most commonly used in spray operations?

(a) Piston Type—(Fig. 74)—An air compressor which develops pressure through the action of a reciprocating piston. Air is drawn in through an intake valve, compressed, then expelled through an exhaust valve to an air receiver or the air line. Piston type compressors are available in single or multiple cylinder and single or two stage models depending on the volume and pressure needed. Compressors of this type are used for heavy duty operations such as supplying air for industrial plants, service stations, garages, maintenance painting, automobile refinishing, and highway maintenance work.

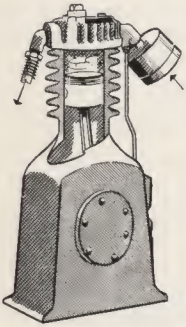


Fig. 74

(b) Diaphragm Type — (Fig. 75)—A small air compressor which develops pressure through the reciprocating action of a flexible disk actuated by an eccentric. A compressor of this type provides sufficient air for use in the home or small shop.

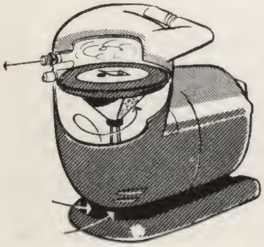


Fig. 75

94. What is a single stage air compressor?
A piston type compressor with one or more cylinders in which air is drawn from the atmosphere and compressed to its final pressure in a single stroke. (See Fig. 74.)

95. Where are single stage compressors used?

Usually where maximum pressures do not exceed 100 pounds.

96. Are single stage compressors practical where pressures above 100 pounds are required?

They can be used, but from an efficiency and economy standpoint are not as advantageous as the two stage compressor for pressures over 100 pounds.

97. What is a two stage compressor?

A compressor with two or more cylinders of unequal size in which air is compressed in two separate steps (Fig. 76). Air is first compressed to an intermediate pressure in the first or larger low pressure cylinder then exhausted into a connecting tube called an intercooler. From the intercooler, the intermediate pressure air enters a smaller cylinder, is boosted to a higher pressure and delivered to a storage tank or the main air line.

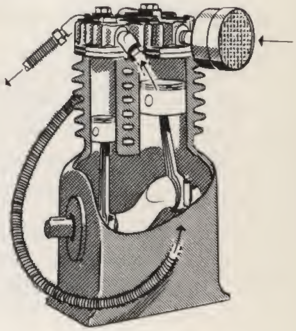


Fig. 76

98. Where are two stage compressors used?

In operations requiring 100 or more pounds of air pressure.

99. Are two stage compressors more economical?

Yes, where pressures of 100 or more pounds are involved, the two stage unit is more efficient, runs cooler, and delivers more air for power consumed.

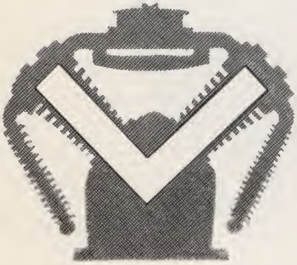


Fig. 77

100. What is a "V" type compressor? (Fig. 77)

A two or more cylinder compressor so called because its cylinders angle off the crankcase to form a "V". Occasionally, this same pump style is termed a "Y" type.

101. What is an upright type compressor?

A single or two stage compressor with the piston or pistons traveling vertically. (See Fig. 76.)

102. What is the displacement of a compressor?

The theoretical or calculated volume (in cubic feet per minute) of air the cylinder or cylinders discharge. In other words, the amount of air moved without allowance for heat, friction or other losses in the compressing cycle.

NOTE: *The displacement of a two stage compressor is always given for that of the first stage cylinder or cylinders only. This is because the second stage merely rehandles the same air the first stage draws in, and cannot increase the amount of air discharged.*

103. How can displacement be computed?

By the following formula:

Area of cylinder x Length of Stroke x R.P.M. = Displacement in cubic inches.

To change the cubic inches to cubic feet, divide the sum by 1728 (the cubic inches in a cubic foot). The formula for computing it is as follows:

$$\frac{(\text{Bore} \times \text{Bore}) \times .7854 \times \text{Stroke} \times \text{R.P.M.} \times \text{No. of Cylinders}}{1728} = \text{Displacement in C.F.M.}$$

Both bore and stroke measurements in the above formula should be in inches. The above formula applies to single stage compressors, but can be used for two stage units since the small high pressure cylinder or cylinders are not computed.

104. What, then, is the "delivery" of a compressor?

Delivery is the *ACTUAL* quantity of free air (expressed in cubic feet per minute) delivered at the outlet of the pump. This can be obtained by actual measurement or by multiplying the displacement by the volumetric efficiency, if it is known. Example: a single stage outfit (for 100 lb. service) has a displacement of 10 C.F.M. Figuring it is 70% efficient at this pressure, the delivery will be: 10 C.F.M. x 70% or 7 C.F.M.

105. What is the volumetric efficiency of a compressor?

The ratio of delivered air to displaced air.

106. What is the average volumetric efficiency of single stage compressors? Of two stage compressors?

Single stage:	Maximum working pressure	75 lbs.	75%
	Maximum working pressure	100 lbs.	70%
	Maximum working pressure	125 lbs.	65%
	Maximum working pressure	150 lbs.	60%
Two stage:	Maximum working pressure	100 lbs.	80%
	Maximum working pressure	125 lbs.	80%
	Maximum working pressure	150 lbs.	80%
	Maximum working pressure	175 lbs.	80%

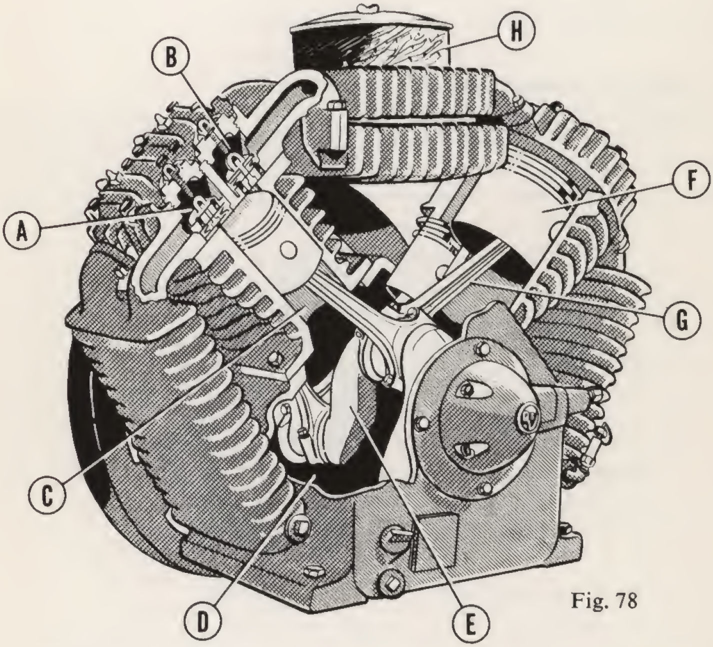


Fig. 78

107. What are the principal parts of a piston type compressor? (Fig. 78) Intake (A) and Exhaust (B) valve assemblies, cylinder (C) and crankcase (D), crankshaft (E), piston (F) and connecting rod assembly (G), and air intake filter (H).

108. What features should a good air compressor have? (Fig. 79)

(a) Easily removable valve assemblies.

(b) Quick acting valves.

(c) Multiple ring piston assembly with both compression and oil control rings.

(d) Honed cylinders.

(e) An efficient cooling system consisting of aftercoolers, cooling fins on cylinders and heads, and a fan fly wheel.

(f) An automatic oiling system with controlled flow such as the oil pick up ring and centrifugal force types.

(g) Anti-friction main bearings.

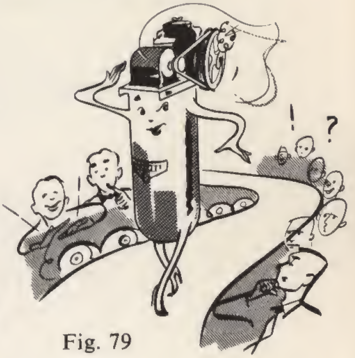


Fig. 79

109. What is an automatic unloader?

An automatic device designed to maintain a supply of air within given pressure limits on gasoline and electrically driven compressors when it is not practical to start and stop the motor during operations. Where the demand for air is relatively constant at a volume approaching the main capacity of the compressor, an unloader is recommended.

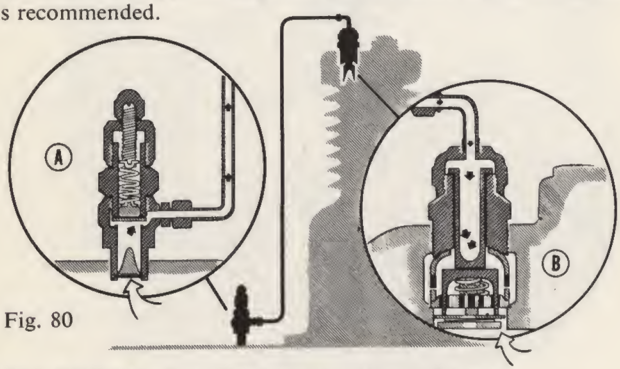


Fig. 80

110. How does the automatic unloader operate?

When maximum pressure in the air receiver is reached, the unloader pilot valve (Fig. 80-A) opens to let air travel through a small tube to the unloader mechanism (Fig. 80-B) and holds open the intake valve on the compressor, allowing it to run idle. When pressure drops to a minimum setting, the spring loaded pilot automatically closes, air to the unloader is shut off causing the intake valve to close and the compressor resumes normal operation. Maximum and minimum pressures can be varied by resetting the pressure adjusting screw on the pilot.

111. What is an automatic pressure switch? (Fig. 81)

A pneumatically operated electric switch for starting and stopping electric motors at predetermined minimum and maximum pressures. Switches with various cut-in and cut-out pressures are available for different requirements. They are used when it is convenient and economical to start and stop the motor. Any outfit which runs intermittently and less than 60% of the time is controlled best with a pressure switch.

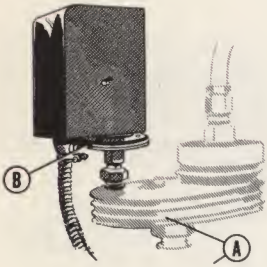


Fig. 81

112. How does the pressure switch operate?

When maximum pressure in the air receiver is reached (A), air pressure on a diaphragm (B) actuates a switch, breaking the circuit and stopping the motor. When pressure drops to a minimum setting, the circuit is closed again, the motor starts and operates the compressor until maximum pressure is reached.

113. What is a motor starter?

An electrical switch designed to provide overload protection or other necessary electrical control for starting motors of various types. The design of the switch varies with different motor sizes and current characteristics. Selection and installation of such switches should be made by a qualified electrician.

114. How are motors protected from overload?

Small motors are generally protected by fuses and large motors by thermal overload relays on the starting devices. Relays are recommended with time delay features so that circuits will not be opened by overloads of short duration not harmful enough to injure the motor. Overload protection should be employed on all compressor installations except the smaller types, designed to operate from the standard wall socket.

115. What is a centrifugal pressure release?

A device which enables the motor to start up and gain momentum before engaging the load of pumping air against pressure.

116. How does the centrifugal pressure release operate? (Fig. 82)

When the compressor slows down to stop, rotating the crankshaft more slowly, steel balls (A) move toward the center where they wedge against a cam surface forcing the cam outward. This opens a valve (B) "bleeding" air from the line connecting to the check valve. With air pressure bled from the pump and after cooler, the compressor can start up free of back pressure until it gets up speed. When normal speed is reached, balls move out by centrifugal force, releasing the cam, closing the valve and air is again pumped into the air receiver.

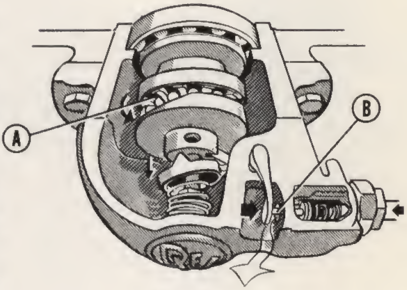


Fig. 82

117. What is an air compressing outfit?

The term "outfit" usually refers to the complete unit for providing compressed air—the compressor (sometimes called the air pump) complete with motor or engine. On large outfits the term also implies the air control equipment and air storage container.

118. What are some of the general types of compressing outfits?

(a) Electric motor or gas engine driven.
(b) Portable or stationary.
(c) Unloader or pressure switch controlled.
(d) Horizontally or vertically mounted air receivers.

119. Where are gas engine driven outfits used?

(a) Where electric current is not available.
(b) Where outfits are to be moved about in localities with different electric current characteristics.
(c) In localities where insufficient current is available.
(d) For maintenance painting and other operations which require a portable air supply.

120. How do portable and stationary outfits differ?

A portable outfit is designed for easy movement. It is equipped with handles, wheels, or casters and usually a small air receiver or pulsation chamber.

A stationary outfit is one permanently located. It is usually equipped with a larger air receiver than the portable type and may have a pressure switch as found on service station compressors or an automatic unloader as found on larger industrial units. Larger stationary models are generally equipped with a centrifugal pressure release.

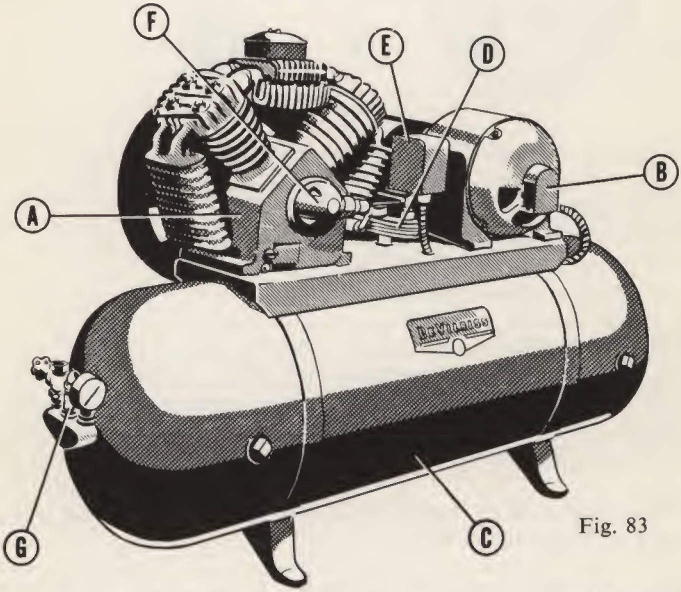


Fig. 83

121. What are the principal parts of a stationary outfit? (Fig. 83)

(a) Air compressor—pumps or compresses the air.
(b) Motor or Engine—powers air compressor.
(c) Air receiver or storage tank—stores compressed air (usually larger than on portable outfits).
(d) Check valve—prevents leakage of stored air back through compressor.
(e) Pressure switch—automatically controls pressure.
(f) Centrifugal pressure releases—on larger models—relieves motor of starting against load.
(g) Safety valve—to protect air lines and equipment.

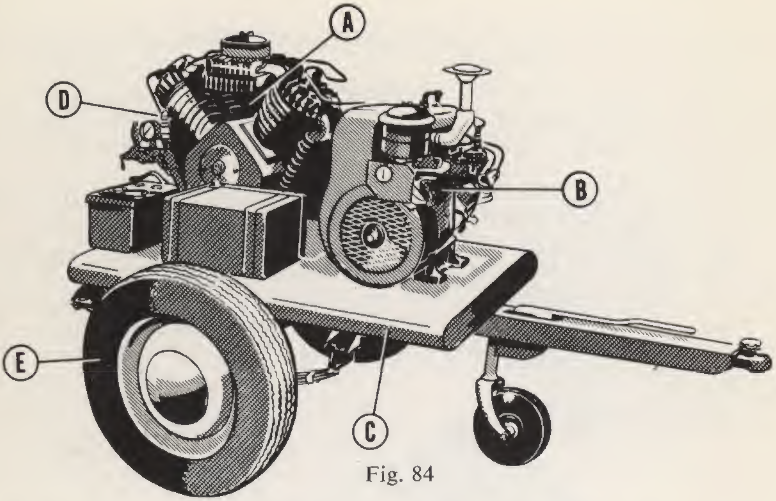


Fig. 84

122. What are the principal parts of a portable outfit (Fig. 84)

(a) Air compressor.
(b) Motor or engine.
(c) Air receiver—(Usually smaller than on stationary outfits).
(d) Unloader—controls pressure automatically.
(e) Wheel, caster or skid mounting.

123. When should a compressing outfit be replaced?

(a) When damage or wear from usage has decreased the efficiency of the outfit.
(b) When capacity of the outfit is unable to supply sufficient air for requirements.
(c) When time from cut-in to cut-out shows waste of electrical energy and the increased overhead would pay for a new outfit. (See below.)

124. How long should it take to pump from cut-in to cut-out pressure on different outfits?

Outfit	H. P.	Cut-in pounds pres.	Cut-out pounds pres.	Time to pump from Cut-in to Cut-out (in seconds)	Tank Size
Single Stage	½	80	100	191	30 gal.
Single Stage	1	80	100	83	30 gal.
Single Stage	2	80	100	69	60 gal.
Single Stage	3	80	100	51	60 gal.
Two Stage	1	140	175	284	60 gal.
Two Stage	3	140	175	115	80 gal.
Two Stage	5	140	175	75	80 gal.
Two Stage	10	140	175	56	120 gal.
Two Stage	15	140	175	42	120 gal.

125. What size compressing outfit should be selected? (Fig. 85)

One that will supply slightly more air than is actually required. This allows for margin or reserve for peak loads, and future additional equipment.

An undersize outfit will cost more due to:

(a) Time wasted waiting for the outfit to build up to required pressure when capacity is not great enough.

(b) Undue strain placed on the compressor during peak loads.

(c) Loss of time caused by air-starved equipment operating inefficiently.

(d) Not being able to add new tools.

(e) Greater possibility of breakdowns.

(f) Excessive running to supply the quantity of air needed.

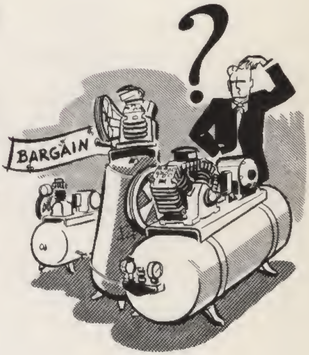


Fig. 85

126. How can the proper size compressor be determined?

By making a survey of a shop's compressed air needs and listing all the air tools to be operated. The following procedure outlines such a survey:

(a) Check all the air operated equipment in the shop, using the accompanying chart (No. 1) to determine air consumption in cubic feet per minute (c.f.m.) and pressure needed to operate various pieces of equipment. (For example—two grease guns would require a total of 6 cubic feet of air per minute and operate within a pressure range of 120 to 150 pounds.)

(b) Add all items listed to determine total free air consumption of average operation. Note the highest pressure required for any of these tools.

CHART NO. 1

Quantity	Type Device	Air Pres. Range	Avg. Free Air Cons.	Total Avg. Air
	Air Filter Cleaner	70-100	3.0	
	Air Hammer	70-100	16.5	
	Body Polisher	70-100	2.0	
	Body Sander	70-100	5.0	
	Brake Tester	70-100	3.5	
	Carbon Remover	70-100	3.0	
	Car Rocker	120-150	5.75	
	Car Washer	70-100	8.5	
	Dusting Gun (blow gun)	70-100	2.5	
	Engine Cleaner	70-100	5.0	
	Fender Hammer	70-100	8.75	
	Grease Gun (high pressure)	120-150	3.0	
	Hoist (one ton)	70-100	1.0	
	*Hydraulic Lift	145-175	5.25	
	Paint Spray Gun (production)	70-100	8.5	
	Paint Spray Gun (touch-up)	70-100	2.25	
	Pneu. Garage Door	120-150	2.0	
	Radiator Tester	70-100	1.0	
	Rim Stripper	120-150	6.0	
	Spark Plug Cleaner	70-100	5.0	
	Spark Plug Tester	70-100	.5	
	Spray Gun (Undercoating)	70-100	19.0	
	Spring Oiler	70-100	3.75	
	Tire Changer	120-150	1.0	
	Tire Inflation Line	120-150	1.5	
	Tire Spreader	120-150	1.0	
	Trans. & Diff. Flusher	70-100	3.0	
	Vacuum Cleaner	120-150	6.5	

*For 8000 lbs. capacity. Add .65 cfm for each additional 1000 lbs. cap.

AIR COMPRESSORS

(c) For automotive service installations, refer to Chart No. 2, Column A.

  (1) Select the pressure range capable of meeting the maximum pressure requirements.

  (2) Within the desired range, locate the line indicating air consumption adequate for the shop's total requirements.

  (3) On the same line in the next column is the correct compressor size.

(d) For installation where use of pneumatic tools is relatively continuous, refer to Chart No. 2, Column B.

CHART NO. 2

Compressor Pressures per Square Inch		COLUMN "A" Average Service Station or Garage Use* Free Air Consumption in Cubic Feet per Minute of Total Equipment	COLUMN "B" Continuous Operation†† Free Air Consumption Cubic Feet per Minute of Total Equipment	COM-PRESSOR Horse-power
Cut-in	Cut-out			
80	100	up to 6.6	up to 1.9	½
		6.7— 10.5	2.0— 3.0	¾
		10.6— 13.6	3.1— 3.9	1
		13.7— 20.3	4.0— 5.8	1½
		20.4— 26.6	5.9— 7.6	2
		30.5— 46.2	8.8— 13.2	3
100	125	46.3— 60.0	13.3— 20.0	5
		60.1— 73.0	20.1— 29.2	7½
		73.1—100.0	29.3— 40.0	10
		100.0—125.0	40.1— 50.0	15
120	150	up to 3.8	up to 1.1	½
		3.9— 7.3	1.2— 2.1	¾
		7.4— 10.1	2.2— 2.9	1
		10.2— 15.0	3.0— 4.3	1½
		15.1— 20.00	4.4— 5.7	2
140	175	up to 11.9	up to 3.4	1†
		12.0— 18.5	3.5— 5.3	1½
		18.6— 24.2	5.4— 6.9	2
		24.3— 36.4	7.0— 10.4	3
		36.5— 51.0	10.5— 17.0	5
		51.1— 66.0	17.1— 26.4	7½
		66.1— 88.2	26.5— 35.3	10
		88.3—120.0	35.4— 48.0	15

*These figures are not to be regarded as the capacity of the compressor in free air output, but instead, are the combined free air consumption of all the tools in the shop, as well as tools anticipated for future added equipment. A factor has been introduced to take into account intermittent operation of tools likely to be in use simultaneously in the average shop or service station.

†Do not use a compressor of less than 1½ H.P. if the pneumatic equipment includes a lift of 8000 pounds capacity.

††These figures are to be employed when the nature of the device is such that normal operation requires a continuous supply of compressed air. Therefore, no factor for intermittent operation has been used, and the figures given represent the compressor capacity in free air output.

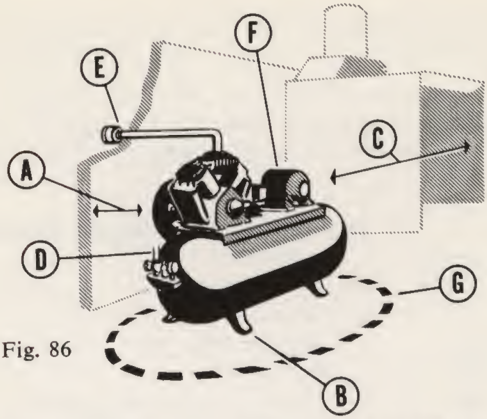


Fig. 86

127. How should a stationary outfit be installed? (Fig. 86)

(a) The unit should be at least one foot from any wall or obstruction so that air can circulate around the compressor to aid in proper cooling.

(b) Compressor should be level and lagged to the floor, preferably with the flywheel toward the wall for safety.

(c) Locate the compressor as near as possible to operations requiring compressed air. This cuts down lengthy air lines which cause needless pressure drop.

(d) Main line air piping should be of sufficient size. (See recommendations page 30).

(e) Place the compressor where it can receive an ample supply of clean, cool, dry air. If necessary connect the air intake to the outside of the building. Distance between the intake and the compressor should be as short as possible for best efficiency and the outside intake should be protected from the elements with a hood, or suitable weatherproof protection.

(f) Motor and switches should be wired by a competent electrician in accordance with the National Electrical Code. Make certain that the motor has the same current characteristics as the power line to which it is connected. Correct type and size of wiring and full power supply will assure sufficient current during starting and other peak load periods.

(g) Place the compressor where it is easily accessible for servicing.

128. What regular care should be given an outfit?

(a) It should be filled with good grade motor oil, S.A.E. No. 10, for ordinary conditions; S.A.E. No. 20 for temperatures above 100°F.; S.A.E. No. 10 that is fluid at sub-zero temperatures, for outside use in winter. Oil should be changed after the first month of operation and then, once every two or three months. Oil level in the crankcase should be checked at least once a week as should electric motor bearings unless they are the grease packed type.

(b) Check belt tension and belt alignment so proper power transmission is achieved.
(c) Blow accumulated dust from all cooling fins including the intercooler and aftercooler.
(d) Check and clean the air intake strainer at least once a week.
(e) Periodically lift the safety valve to make sure it will function when necessary.
(f) Make certain that the flywheel is tight on the crankshaft.

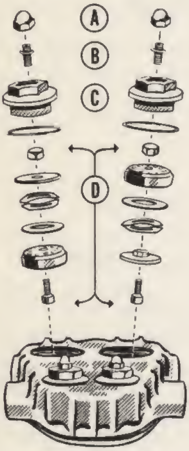


Fig. 87

129. How are valves removed and replaced? (Fig. 87)

(a) Remove cap nuts.
(b) Loosen set screws two turns.
(c) Remove valve caps. Valve assemblies can then be removed.
(d) Disassemble the valve assemblies. Do not clamp the valve seats or guides in a vise. Remove the jam nut. In case of a broken valve, the valve seat should not be reused unless the seat rings are leveled by rubbing on fine sandpaper (No. 400) held on a smooth, flat surface.
Black spots on the valve circumference indicate blow-by, a sign that the valve is leaking and should be replaced.

130. What causes a compressor to knock?

(a) Carbon on piston.
(b) Loose or worn wrist pin.
(c) Connecting rod bearing worn.
(d) Worn main bearings.
(e) Valve assemblies improperly installed.
(f) Loose flywheel.

131. What causes the compressor to heat up?

(a) No oil in crankcase.
(b) Valves sticking.
(c) Insufficient air circulation due to the outfit being located too close to the wall, in a confined space, etc.
(d) Cylinder and head coated with a thick deposit of paint or dirt.
(e) Valves dirty or covered with carbon.
(f) Sticking check valve.
(g) Too heavy oil.
(h) Broken exhaust valve.
(i) Air strainer clogged up.

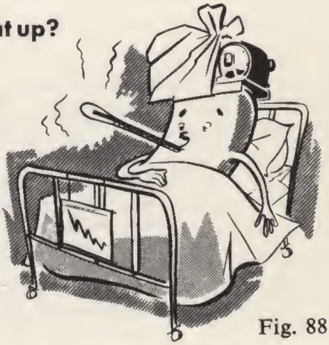


Fig. 88

AIR COMPRESSORS

132. What causes compressor to operate longer periods than normal?

(a) Clogged air strainer.
(b) A thick deposit of paint or dirt on cylinders.
(c) Leakage in air line.
(d) Dirty or warped valves.
(e) Excessive demands for compressed air.

133. What causes compressor to pump oil?

(a) Clogged air strainer.
(b) Inferior piston rings.
(c) Worn piston rings.
(d) Too much oil.
(e) Clogged intake valve.

RESPIRATORS

134. What is a respirator?

A mask worn over the nose and mouth to prevent the inhalation of toxic pigment particles, harmful dust and in some cases—vapors, which may be suspended in the air during spraying or similar operations.

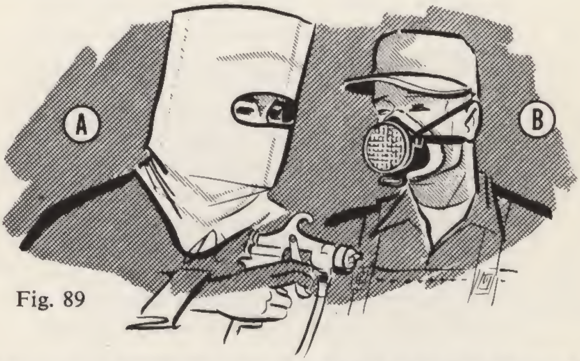


Fig. 89

135. What types of respirators are used by spray operators? (Fig. 89)

The two most suitable types designed for the spray painter are the hood respirator and those for adsorbing organic vapors. A third type, designed primarily for dust, is also suitable in certain instances explained below.

(a) Hood respirators protect the wearer from heavy concentrations of vapor, fumes, dust and dirt that might prove harmful to respiratory organs, eyes, ears, and exposed skin. They can be used where other types of respirators are impractical and do not provide sufficient safeguard in extreme cases.

A hood respirator is a covering for the head equipped with a window or opening and an air line which supplies pure air under pressure that exhausts through a front opening, preventing fumes or particles from entering. Hoods of this type are available in paper, cloth and transparent material.

(b) Organic vapor types are equipped with cartridges that remove organic vapors by chemical adsorption. Some are also equipped with a pre-filter which removes solid particles from the air before passing it through the chemical cartridge.

(c) Dust respirators equipped with filters that remove solid particles from the air are often used by spray painters. They are satisfactory only if the material being sprayed contains no harmful vapors. Water-mixed paints, for example, could be sprayed safely wearing a respirator of this type. However, the dust respirator is used primarily in operations such as surface preparation involving sanding, grinding, buffing and polishing.

They are also used in other dust producing operations such as drilling, blasting, crushing and abrading. Models approved by the Bureau of Mines protect against all dusts not significantly more toxic than lead, while others are available for protection against light nuisance dusts produced in grinding operations, coal yards, grain elevators, cement mills, woodworking plants and exposures not producing pneumoconiosis, silicosis or asbestosis.

EXHAUST EQUIPMENT

136. What is a spray booth?

A compartment, room or enclosure, generally of fireproof construction, built to confine and exhaust overspray and fumes resulting from spray painting or similar operations. There are numerous models of booths designed for various materials sprayed, types of objects coated and different methods of application.

137. What are some of the factors which make a spray booth advantageous?

(a) Segregates spraying operations in an enclosure for cleanliness and safety.

(b) Reduces fire and health hazards.

(c) Promotes cleaner conditions both for the spray operator and for the object being sprayed. Provides an area that can be kept clean more easily and also more effective dust control.

(d) Protects the health of spray operators by removing overspray and fumes from the working area.

(e) In a spray booth equipped with adequate lighting, better control of finishes is possible.

138. What are the two basic types of spray booths?

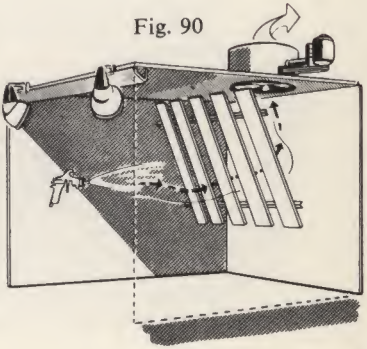
(a) Dry Type.

(b) Air Washer Type.

139. What is a dry type booth? (Fig. 90)

A spray booth which draws contaminated air through baffles or removable filters before expelling it directly to the outside. A booth of this type is commonly used for spraying lacquers and quick-drying materials. The booth is used in locations where it is unnecessary to prevent overspray from being discharged to the outside atmosphere. Dry spray booths are available in floor, leg and bench types.

Fig. 90



140. What factors determine the selection of a dry type booth?

(a) If the material being sprayed does not present a nuisance when expelled.

(b) When a less expensive installation is desired and a lower initial cost mandatory.

(c) When small quantities of work are to be sprayed at infrequent intervals.

(d) If the exhaust stack can be located where expelled air, even though it contains overspray, will not present any problems.

141. What is an air washer spray booth? (Fig. 91)

A spray booth which draws contaminated air through a series of water curtains and baffles to remove solids from overspray before it is exhausted. An air washer booth reduces fire hazards and is used where conditions require that exhaust air be clean when it leaves the stack. Particles of overspray from materials such as varnish, and enamels are efficiently removed and confined in the water chamber. This prevents expulsion of spray dust that might be a nuisance outside.

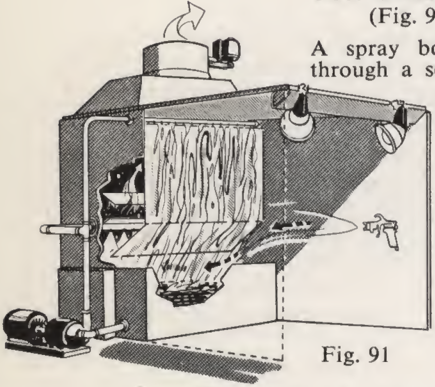


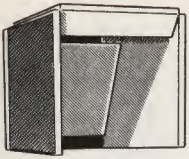
Fig. 91

142. What factor determines the selection of an air washer booth?

When it is necessary to remove solid particles from overspray. An air washer booth will remove 95% to 99% of paint residue from the air before it is exhausted.

143. What other factors determine the selection of a booth?

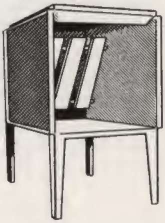
The spray booth style desired (cross-flow, downdraft, canopy, etc.) is dependent on the article being coated and the method of application of the material. Following is a general list of various spray booth styles, the type or size of articles they are capable of handling, and the method used in applying the materials.



Booth Style—Bench.

Type or Size of Article Handled—
Very small articles.

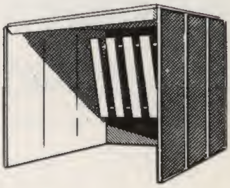
Method of Application—
Hand or semi-automatic.



Booth Style—Leg.

Type or Size of Article Handled—
Small articles.

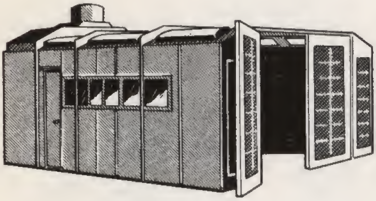
Method of Application—
Hand or semi-automatic.



Booth Style—Floor.

Type or Size of Article Handled—
Larger articles that can be sprayed at floor level.

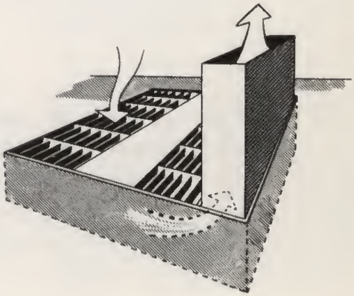
Method of Application—
Hand, semi-automatic or automatic.



Booth Style—
Automotive Refinishing.

Type or Size of Article Handled—
Automobiles, trucks, trailers and other similar sized objects.

Method of Application—Hand.



Booth Style—
Downdraft—Overspray is drawn downward, usually through a grating in the floor.

Type or Size of Article Handled—
Usually used where larger articles are of such a nature that the downward flow of air is more convenient or practical for the job. Downdraft type units often require no booth enclosure.

Method of Application—
Hand, semi-automatic, or automatic.

Booth Style—

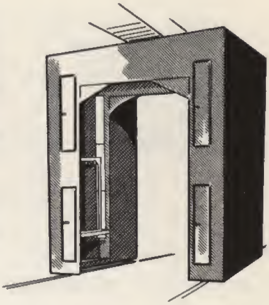
Traveling Booth—Self-propelled spray booth which straddles vehicles and travels along them while all surfaces are painted by operators, raised or lowered on elevators. This booth is also equipped with its own air compressors and filtered air ventilation. Booth can be equipped with an automatic spraying machine.

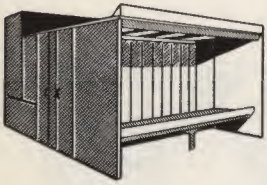
Type or Size of Article Handled—

Railroad cars, locomotives, busses, trucks, and other large objects which remain stationary while being painted.

Method of Application—

Hand or automatic.





Booth Style—

Ceramic Booths—Either air washer or dry type, designed especially for exhausting ceramic or similar dusty, gritty, and abrasive materials.

Type or Size of Article Handled—

Most sizes of objects requiring porcelain enamel or similar finishes.

Method of Application—

Hand, semi-automatic, or automatic.

144. What is an exhaust fan? (Fig. 92)

An exhaust fan is a unit consisting of a motor, multiple blade fan, pulleys and belt or belts for removing fumes or overspray from a work area. Exhaust fans for spray use are designed to prevent overspray coming in contact with the drive mechanism. The blades are made of non-sparking metal and scientifically shaped to move a maximum volume of air per horsepower against the resistance set up by exhaust stacks, baffles, filters, etc.

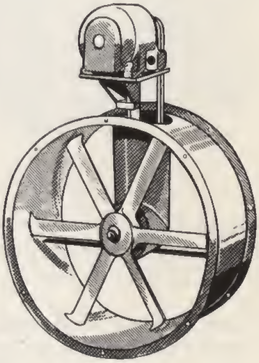


Fig. 92

145. What is velocity and what is its effect on efficient operation of a spray booth?

Velocity is the speed of air through the booth. If the velocity is too low, overspray will not be expelled properly. Too high a velocity results in objectionable drafts, excessive amounts of dirt and dust being drawn into the booth, and during winter months, a greater loss of heat.

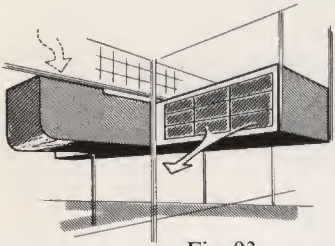


Fig. 93

146. What is an air replacement unit? (Fig. 93)

A system of blowers, filters and heaters which provides clean, heated, filtered make-up or replacement air for spray booths or areas containing them. Air replacement systems are necessary when the product being finished requires an area free of dust, lint and foreign matter and even, controlled temperature. Systems are also provided when normal ventilation will not supply air in a sufficient volume for efficient operation of the exhaust system. Most factories do not have facilities for maintaining proper temperatures in finishing rooms when large amounts of air are exhausted and therefore require some other means of providing heated air.

Spray Booth Maintenance

147. Why is care and cleaning of spray booths important?

(a) To reduce fire hazards caused by accumulated overspray.
(b) To maintain the efficiency of the booth.
(c) To prevent freshly painted objects from becoming blemished.

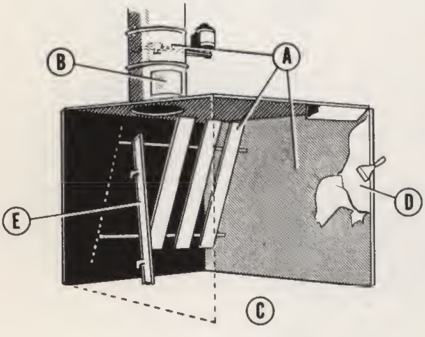


Fig. 94

148. What is important in the maintenance of dry type booths? (Fig. 94)

(a) A spray booth coating should be applied to interior booth walls, distributing plates, the fan and exhaust stack. When overspray accumulates on the coating, it can easily be removed.
(b) Since a considerable portion of the overspray enters the exhaust stack and must be removed, it is important that the stack be designed with accessible clean-out doors.
(c) Cleaning of the booth should be regularly scheduled so that fire hazards are reduced and the full efficiency of the system is maintained. Accumulated overspray results in fire hazards and increased resistance of air flow.

(d) Removal of the booth coating and overspray must be done with a non-ferrous, non-sparking scraper to eliminate any possibilities of igniting combustible material.

(e) Distributing plates should be taken out and all overspray removed.

149. What is important to the maintenance of air washer booths? (Fig. 95)

(a) Booth coating need be applied only to the dry surfaces of the booth enclosure. The water wash eliminates the necessity for coating the fan and stack since overspray is removed from the air before it reaches these points.

(b) Water in the washing chamber tank must be changed and compounded regularly to maintain the efficiency of the booth.

The primary function of compounding is removal of the stickiness from overspray so that it will not adhere to the working portion of the washing chamber. To do this, a material called "water wash compound" is added to the water. The amount to be used and the amount to be added should be determined by following the recommendations of a reputable compound supplier. Water wash compounds also prevent rusting.

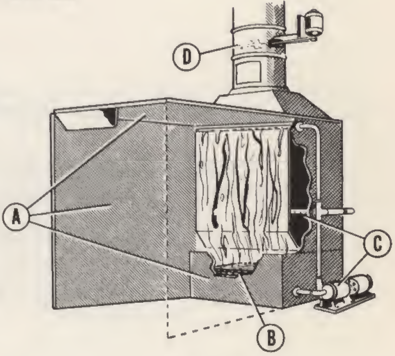


Fig. 95

The residue that floats on the surface of the water should be removed at the end of the working day, otherwise it is apt to sink to the bottom of the water chamber. Where high production occurs, skimming off this residue may be required even more often. At regular intervals, depending on the usage of the system, drain the water tank completely and remove any sludge that has settled to the bottom. Then refill with water and add a fresh charge of compound.

(c) While the water chamber is opened for cleaning, test the pump in order to check the header and nozzles for clogging or fouling. If the nozzles are dirty, they should be removed and cleaned.

(d) Normally the fan and the exhaust stack will require little if any cleaning, unless compounding has been neglected, nozzles are clogged or periodic cleaning overlooked.

NOTE: *Avoid coating spray booths, either air washer or dry type, with grease or paper. This presents another fire hazard.*

OPERATING SPRAY EQUIPMENT

Here are some general rules and suggestions for hooking up spray equipment, adjusting and operating it properly. There is no substitute for practical experience in handling spray equipment and as with most other jobs, practice is essential for best results. Poor spray technique, and incorrect assembly and operation of equipment invariably result in poor finishes.

Preparing And Adjusting Equipment

150. How is suction feed equipment hooked up for operation? (Fig. 96)

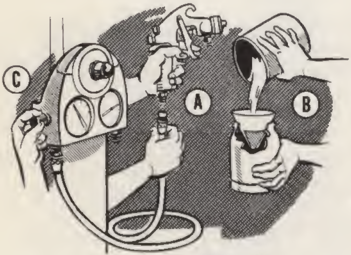


Fig. 96

(a) Connect air hose leading from the air outlet, preferably on the transformer, to the air inlet on the spray gun.

(b) After the material has been reduced to proper consistency, thoroughly mixed and strained into the cup, attach the gun to the cup.

(c) Open the air outlet valve on the transformer and adjust the atomization air to the required pressure.

151. How is the suction feed spray gun adjusted for spraying?

(a) Open the spreader adjusting valve.

(b) Back out the fluid adjusting screw to a wide-open position. (Wide-open position is reached when the first thread of the screw is visible.)

(c) Spray a test pattern to check for uniform material distribution. (See spray patterns, page 16.)

(d) Spray a small area to check the speed of operation. (Fig. 97)
  (1) If the spray pattern seems starved for material, open the fluid adjusting screw or thin the material if it is too heavy.
  (2) If the material sprays too fast—reduce the material flow by turning in the fluid adjusting screw or lower the atomization air pressure.

(e) If atomization is too fine (recognized by excessive overspray or dry spray)—reduce the atomization pressure making sure the fluid adjustment is wide open.

If the atomization is too coarse, (recognized by speckled effect or dimpled finish lacking flowout) increase the atomizing air pressure or reduce the material flow.

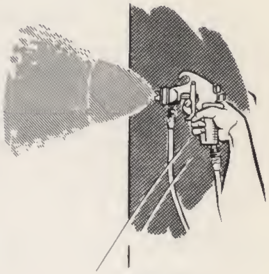


Fig. 97

(f) The normal pattern for a production type gun should be approximately 10 inches wide when the gun is held 6 to 8 inches from the surface.
  (1) If the spray pattern is too narrow—make sure the spreader valve and fluid screw are wide open and increase the fluid flow by raising the atomizing pressure or by thinning the material.

In many cases a wetter coat may be obtained by turning in the spreader valve to narrow the spray pattern and then slightly increasing the atomizing pressure.

152. How is portable pressure feed equipment prepared for spraying?

(a) Connect air hose from the compressor to the pressure feed tank or material pump air inlet.

(b) Attach air hose from the air outlet on the pump or tank to the air inlet on the spray gun. If atomization air to the spray gun is controlled by an air adjusting valve instead of double regulation on the tank, it will be placed at the spray gun air inlet.

(c) Connect the fluid hose from the tank (or pump) fluid outlet to the fluid inlet on the spray gun.

(d) Place properly prepared material in the tank and replace lid making certain to securely tighten all lid clamps (Fig. 98). (If a material pump is used, place it in the container of material.)

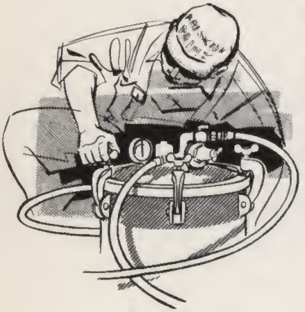


Fig. 98

(e) Close the release valve on the pressure feed tank.

(f) Turn all regulator knobs counter-clockwise to release spring tension.

(g) Start the compressor.

(h) Open all valves except the one supplying air to the gun.

(i) Open the air spreader and fluid adjusting screw at the spray gun.

(j) With the gun pointed into a container, pull the trigger and slowly admit pressure to the tank or air motor of the material pump until material flows from the gun. Long lengths of hose will require some time for material to reach the gun and care should be taken that excessive pressure is not placed on the tank or pump.

(k) (Fig. 99) Adjust the fluid flow to approximately a pint per minute. (This requires about 10 to 15 lbs. air pressure on the tank.) This figure is arbitrary since different materials flow at different rates, but it provides a basis for setting the fluid adjustment.

(l) Adjust the air pressure with the air regulator on the pump, the regulator on a double regulated tank, or the air adjusting valve at the gun, according to whichever method is used.

(m) Introduce enough air to provide a coarsely atomized, uniform fan shaped pattern. Keep in mind that the lowest pressure that can be successfully used will lessen overspray.

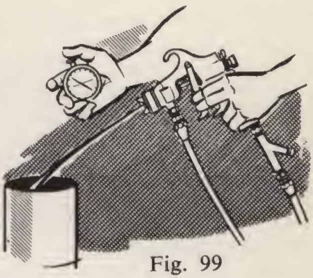


Fig. 99

(n) Spray a small section, using the correct spray technique and inspect it for proper film thickness, coverage, and whether the material flows out to form a smooth, wet coat.

(o) If faster or slower application is required, readjust the fluid flow up or down as the case may be and again balance the atomization air to produce the desired degree of atomization. When operating the gun at higher levels, air pressure should be readjusted at the rate of an additional 1/2 to 1 pound or more, depending on the weight of the spray material, for each added foot of elevation. (Fig. 100)

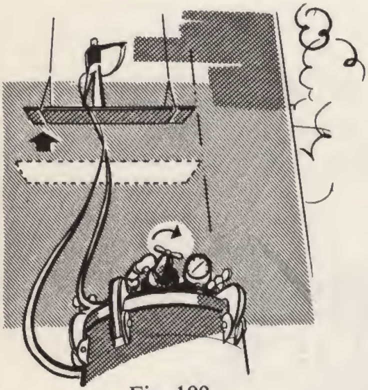


Fig. 100

153. How is industrial pressure feed equipment prepared for spraying?

(a) Connect an air hose from a regulated outlet of the transformer to a pressure feed tank. When necessary to maintain a fluid pressure higher than the atomization pressure, air must be supplied to the tank from a main line air outlet and the gun connected to a separate regulated air outlet of the transformer.

(b) Place properly mixed and strained material in the container and fasten the lid securely with all the clamps run down tight.

(c) Before turning on the air to the pressure feed tank, turn the tank regulator handle counter-clockwise to release spring tension. Then close the release valve.

(d) Introduce air to the pressure feed tank slowly.

(e) As a starting point, an arbitrary atomization air and fluid pressure must be selected.

(f) (Fig. 101) Adjust the air pressure on the tank to approximately 15 pounds (A).

(g) Adjust the atomization air pressure by starting at 65 pounds (B), raising and lowering it until the desired atomization is obtained.

(h) Spray a small area.

(i) If faster application is needed, increase the fluid pressure first and then readjust air to obtain proper atomization. On the other hand, if the output is too great, reduce the fluid and air pressure in that order, to reach the desired point.

(j) The most efficient atomization pressure is the lowest possible air pressure that will give the desired results. As air pressure is decreased, overspray is reduced and a higher percentage of material is deposited on the surface. The resultant savings in material are a good reason for spraying at the lowest possible pressure.

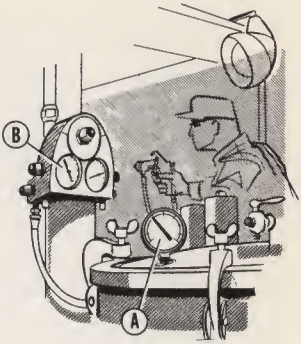


Fig. 101

Spray Technique

154. How should the spray gun be held?

It should be held perpendicular to the surface at all times, keeping the gun from 6 to 8 inches from the surface being sprayed. A simple method of determining the proper distance is shown in Fig. 102.

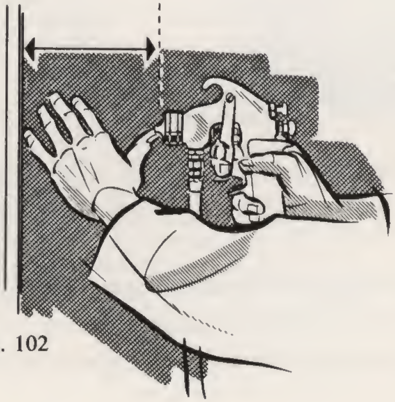


Fig. 102

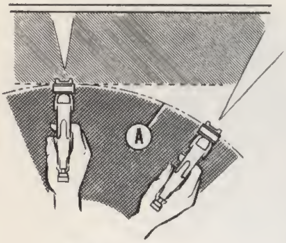


Fig. 103

155. How is the proper spray gun stroke made?

The stroke is made with a free arm motion, keeping the gun at right angles to the surface at all points of the stroke. The ends of the strokes are "feathered" out by triggering the gun. Correct triggering involves beginning the stroke before pulling the trigger and releasing it just before ending the stroke. (See Fig. 103.) Arcing the gun (A) results in uneven application and excessive overspray at each end of the stroke. When the gun is arced 45° away from the surface, approximately 65% of the material is lost. *Lap each stroke 50% over the preceding one.* Less than 50% overlap will result in streaks on the finished surface. Move the gun at a constant speed while the trigger is pulled, since the material flows at a constant rate.

156. How are corners sprayed?

Holding the gun pointed at the corner, spray both surfaces at once. (Fig. 104) Then, spray each side, blending into this coated area. This method reduces overspray falling on adjacent surfaces. For inside corners, spray each side separately to prevent material from piling up.

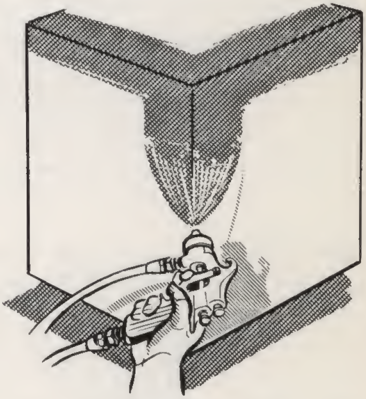


Fig. 104

157. What causes orange peel?

Orange peel is a finishing defect common to lacquer and synthetic materials, so called because it resembles the texture and appearance of an orange peel. General causes are:

(a) Improper thinner.

(b) Either too high or too low an atomization pressure.

(c) Holding the gun either too far or too close to the work.

(d) Material not thoroughly mixed or agitated.

(e) Drafts in the finishing room, if spraying synthetics or lacquers.

(f) In spraying synthetics, too low humidity.

(g) Improperly prepared surface.

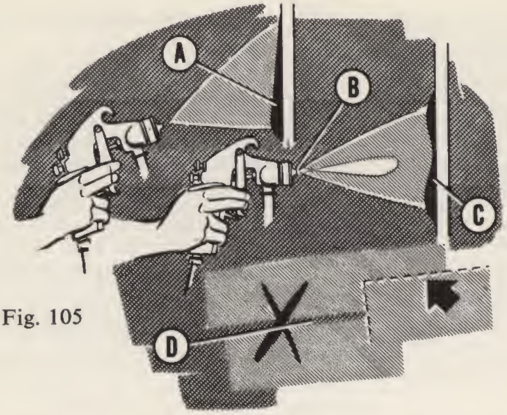


Fig. 105

158. What causes streaks on a finished surface? (See Fig. 105.)

(a) Tipping the gun. One side of the pattern hits surface from a shorter distance causing more material to be applied at this point.

(b) Air cap or fluid tip may have dirt or burrs on it, causing heavy top or bottom patterns. (See spray patterns, page 16.)

(c) "Split Spray" causing more material to be applied at the top and bottom of the pattern. Increase the fluid pressure or decrease the width of the pattern by reducing the atomizing pressure.

(d) Spray patterns not properly lapped. (See spray stroke, page 57.)

159. What causes runs and sags in finishes?

(a) Sags are the result of too much material applied on the surface. Runs also result from the material being too thin.

(b) If the gun is tilted at an angle, excessive material is supplied where the pattern is closest to the surface, causing it to pile up and sag.

160. What causes mist or fog?

(a) Material too thin.

(b) Over-atomization due to too high an atomizing air pressure for the amount of fluid flowing.

(c) Improper use of the gun such as incorrect stroking or the gun being held too far from the surface.

161. What is "starving" the spray gun? (Fig. 106)

Insufficient air or fluid reaching the gun.

Not enough air reaching the gun may be due to:

(a) Air transformer clogged with rust or dirt.

(b) Air valves too small in size.

(c) Clogged air lines.

Fig. 106

(d) Air hose or pipe line too small in diameter.
(e) Inadequate air supply.

The gun may be "starved" for fluid due to:
(a) Insufficient pressure on the tank.
(b) Too small a fluid hose.
(c) Too small a fluid tip.
(d) Fluid adjusting screw on the gun not opened wide enough.
(e) Material too heavy.

162. What is the procedure in doing a touch-up job on metal?

(a) Wash the surface to be painted thoroughly with water to eliminate dirt. Then wash with wax removing solvent. All wax must be removed or the new finish will not adhere properly.
(b) Sand the spot or scratch. Be sure a good feather edge is obtained. This should be so gradual or finely tapered that metal cannot be detected from the finish by touch.
(c) Liberally build up the sanded spot with primer-surfacer, making certain that it extends beyond the feathered edges and is applied heavier than the surrounding finish. (Fig. 107)
(d) Then sand until level and perfectly smooth.
(e) Apply finish material.
(f) A coat of thinner will smooth out rough spots in lacquer finishes—caused by dry spraying or overspray.

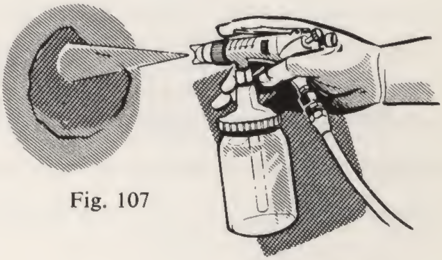


Fig. 107

In order to present the basic facts on spray equipment as simply and briefly as possible, detailed and technical data has been purposely eliminated from this booklet. If further information on the selection, operation or maintenance of spray equipment, or if recommendations for the application of materials is desired, the reader is cordially invited to write the DeVilbiss Company, Toledo 1, Ohio.

As a service to DeVilbiss users and distributors, the company maintains a training school with classes for automotive, industrial and maintenance painters. More information on these tuition-free courses may be had by contacting a DeVilbiss representative or distributor or by writing directly to the company.

A customer research laboratory is also available to test various types of materials and methods of application and recommend the proper equipment and procedures to solve finishing problems.

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